

**2009 D&R #4 Crude/DEBRU**

**PHA REVALIDATION REPORT**

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Richmond, CA  
December 1, 2009

## REVALIDATION OF THE D&R #4 CRUDE UNIT PROCESS HAZARDS ANALYSIS (PHA)

### CARL SIMMERS:

The Final Report for the 2009 PHA Revalidation of the **D&R #4 CRUDE UNIT** has been completed. This revalidation was conducted from August 31 through November 17, 2009. This scope of this PHA covered D&R #4 Crude Unit and D&R DEBRU.

The PHA team reviewed every section of the previous PHA and re-ranked each deviation with the new Chevron Integrated Risk Prioritization Matrix.

Representatives from Operations and Engineering provided input regarding the current condition of the plant. Team members were knowledgeable of the process and plant conditions. The team consisted of:

- |                   |                     |
|-------------------|---------------------|
| • Jacques Cartier | Operations          |
| • Ben Purvis      | Process Engineering |
| • Ben Hulse       | Designs Engineer    |
| • Mark Crow       | Facilitator         |
| • Sean Negron     | Scribe (AcuTech)    |

The statement of qualification for each of the team members is included in the report. The revalidation team developed, or sustained, 29 PHA recommendations which are summarized in the Recommendations section of the PHA report, and detailed in the PHA Worksheets.

This analysis complies with the following requirements:

- California Office of Safety Health Administration (OSHA) Process Safety Management (PSM), Title 8, § 5189.
- California Accidental Release Prevention (Cal/ARP) Program, Title 19, § 2760.2
- City of Richmond Industrial Safety Ordinance (RISO) 42-01 § 6.43.90, and
- Section B of the Contra Costa County Industrial Safety Ordinance Guidance Document (adopted by reference within RISO 42-01).

The CalOSHA regulation requires the employer to review and act upon the findings of the PHA in a timely manner. Specifically, the regulation requires the employer to document what actions are to be taken, develop a written schedule of when these actions are to be completed, or document why action was not taken. RI-363 provides guidance for timely completion of the Recommendations. This report incorporates the Recommendation Resolution Plan developed by the ABU.

The CalOSHA regulation requires that the findings resulting from this review be communicated and made available to the affected personnel. This report incorporates the Communication Plan developed by the ABU.

An electronic copy of all the PHA documents is located on the Shared Data server in the folder O:\Psm\Mod-only\PHAfiles\2009 Revalidations\2009 No 4 Crude. A paper copy is available in the HES Library on the third floor of the Tech Center. A read-only copy of the Section Listing and the PILA worksheets is available on the refinery intranet by navigating from the refinery home page to HES, PSM, Process Hazards Analysis, PHA Findings and searching for the D&R ABU Area and # 4 Crude Unit, "Display PHA Findings" and clicking on the link to the "Entire Report" from that page.

The CalOSHA regulation governing Process Hazard Analysis requires that PHAs be revalidated every five years. The **D&R #4 CRUDE UNIT PHA** is due to be revalidated by December 1, 2014.

If you have questions, please call me at extension 2-2071.

MARK CROW

cc: KAREN DRAPER  
Tim Storrs

Attachment: Revalidation Process Description

# PHA Recommendations

Recommendations	Place(s) Used	Safety Category	Chevron PHA Risk Matrix	PH A / SO A	Resolution Plan	Assigned to:	Date Due
1. Concern is that line-ups to P-1129A suction and discharge are not clearly labeled in the field. This could result in the mis-manifolding of the pump. Applies to P-1149A and P-1189A.  Consider properly labeling suction and discharge of P-1129A, P-1149A, P-1189A in the field.	31.4.1.1	A	7	PH A	Clearly label suction and discharge of P-1129A, P-1149A, P-1189A in the field.	Silvano Preciado	12/1/2010
2. Concern is that operations may not have adequate time to respond to changes in feed composition. Reference MITS 2006-903 and MITS 2007-2144.  Consider installation of an in-line gravity analyzer to indicate composition change in feed.	1.1.2 .1	S	7	PH A	Declined, safeguards considered adequate for safety purposes. Under review as optimization item.		
	1.1.3 .1	S	7	PH A			
3. Concern is that employees taking samples of desalter effluent may be exposed to H2S.  Consider upgrading desalter effluent sample station to minimize chance of H2S exposure.	1.11.2.1	S	6	PH A	Modifications to V-1102 sample station in progress to mitigate personnel exposure during sampling. Reference MOC 19520	Silvano Preciado	12/1/2010
4. Concern is that MOV-023 may not close when signal is given either from the board or locally. This is an issue during both routine shutdowns and emergencies.  Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed.	1.2.2 .1	S	6	PH A	Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed.  Shutdown item (8/11).	Silvano Preciado	12/31/2011
5. Concern is that liquid carryover to a compressor may cause equipment damage with loss of containment. An event occurred in 7-09 involving K-1171 for which a Taproot investigation is in progress (LI # 1564125).  Ensure completion of the Taproot study and completion of any resulting corrective actions.	4.1.1 .1	S	5	PH A	Ensure completion of the Taproot study (LI # 1564125) and completion of any resulting corrective actions.	Gerald Lee	12/1/2010
6. Concern is that loss of nitrogen purge to K-1100s and K-1171s distance pieces could result in operator exposure to H2S/process gas.  Consider adding flow indicator readings to handhelds.	6.4.1 .1	S	6	PH A	Consider adding flow indicator readings to handhelds.	Jacques Cartier	12/1/2010
	66.4.1.1	S	6	PH A			
7. Concern is personnel exposure to steam or hot condensate when C7-64 on V-1197 opens to atmosphere.  Consider identifying area as potential steam hazard using RI-321 (Preventing Exposure to Corrosive Chemicals and Defining Yellow-Lined Areas)	8.15.2.1	S	6	PH A	Consider identifying area as potential steam hazard at C7-64.	Silvano Preciado	12/1/2010
8. Concern is personnel exposure to benzene/H2S due to P-1106/A running during shutdown causing leak at a flange from overpressurization.  Shutdown procedure 4CU-NP-3010 does not include demulsifying chemical pump shutdown. Add this to the procedure.	12.12.1.1	S	6	PH A	Shutdown procedure 4CU-NP-3010 does not include demulsifying chemical pump shutdown. Add this to the procedure.	Jacques Cartier	12/1/2010

Recommendations	Place(s) Used	Safety Category	Chevron PHA Risk Matrix	PHA/SOA	Resolution Plan	Assigned to:	Date Due
9. Concern is that if PV-055 on aqueous ammonia recirculation line closes during normal operation, pressure increase may be sufficient to cause flange leak and release of aqueous ammonia to atmosphere.  Consider evaluating aqueous ammonia injection pumps P-1108/A for overpressure protection to prevent flange leaks and aqueous ammonia release when PV-055 closes.	13.1 1.1	S	6	PHA	Confirm proper pipe rating in place.	Ben Hulse	12/1/2010
10. Concern is that loss of velocity steam during shutdown can result in backflow of crude into the steam system, causing possible valve damage, release of hot crude, and personnel injury. Check valve in line is not considered a reliable safeguard.  Consider updating shutdown procedure to include blocking in velocity steam to furnace passes once steam generation system is shut down.	44.1 2.1.1	S	6	PHA	Consider updating shutdown procedure to include blocking in velocity steam to furnace passes once steam generation system is shut down.	Jacques Cartier	12/1/2010
11. Concern is that C-1100/1160 level indication may not meet best practices.  Consider review of best practices to determine if total level indication should be added to C-1100/1160.	45.1 2.1.1	A	5	PHA	Consider review of best practices to determine if total level indication should be added to C-1100/1160.	Ben Purvis	12/1/2010
	60.1 2.1.1	A	6	PHA			
12. Concern is possibility of setting-up in 142 line (TKN cold tankage), especially during low ambient temperature conditions, and that there is no flow indication on this line.  Consider adding a flow meter downstream of PC-984.	34.6. 1.1	A	7	PHA	Consider adding a flow meter downstream of PC-984.  Shutdown item (8/11).	Ben Purvis	12/31/2011
13. Concern is that employee can be injured due to exposure to hot 8 side cut during sampling.  Consider reviewing 8 side cut sample station to reduce potential for personnel injury.	34.1 5.1.1	S	7	PHA	Consider reviewing 8 side cut sample station to reduce potential for personnel injury.	Ben Hulse	12/1/2010
14. Concern is that E-1164A-F may not have sufficient protection for overpressure situations.  Consider reviewing overpressure protection for E-1164A-F, particularly for long loop operations.	71.1 2.1.1	S	7	PHA	Verify spec break and overpressure potential for E-1164s.	Ben Hulse	12/1/2010
15. Concern is that the 10" block valve to tankge can be left open during long loop operations resulting in reverse flow of off-test material to crude unit, delaying startup/shutdown and causing loss of profit. Prior to the latest shutdown (07-09), no written long loop procedure existed.  Consider establishing a written long loop procedure to ensure that the 10" valve to off-test tankage is not left open during long loop.	71.1 2.3.1	A	6	PHA	Consider establishing a written long loop procedure to ensure that the 10" valve to off-test tankage is not left open during long loop.	Jacques Cartier	12/1/2010
16. Concern is that current list of PRDs does not agree with EOMs or handhelds.  Consider revising list of PRDs in EOMs and on handhelds.	74.1. 4.1	S	7	PHA	Consider revising list of PRDs in EOMs and on handhelds.	Jacques Cartier	12/1/2010

Recommendations	Plac e(s) Use d	Se veri ty Cat egor y	Chevro n PHA Risk Matrix	PH A / SO A	Resolution Plan	Assigned to:	Date Due
17. Concern is that existing corrosion probes are not routinely used to monitor corrosion rate in atmospheric column overhead.  Review use of corrosion probes (awareness, maintenance, monitoring, etc.) in atmospheric column overhead.	2.13. 1.1	S	6	PH A	Will repair and commission remaining two corrosion probes (outlet) during next shutdown (8/1).	Ben Purvis	12/31/2011
18. Concern is that neither primary nor secondary heat exchanger trains have adequate overpressure protection.  Per BIN review: El Segundo has similar exchanger train design as Richmond, only El Segundo has overpressure protection.  Consider review of overpressure protection for primary and secondary heat exchanger trains are adequate.	14.1. 1.1	S	7	PH A	Review current overpressure protection for primary heat exchanger train (LV-054).	Ben Purvis	12/1/2010
19. Concern is personnel exposure to steam or hot condensate while blowing down V-1177 for level control during shutdowns and startups.  Recommendation from 2004 PHA addresses 2006 shutdown, but states "Find other locations for future s/d's"  Consider permanent blowdown piping for V-1177 routed to a process drain.	46.1 2.1.1	S	7	PH A	Review blowdown piping for V-1177, add routing to shutdown procedures, temporary piping list.	Jacques Cartier	12/1/2010
20. Concern is that a valve may be left in improper position while placing equipment back in service, leading to loss of containment and personnel injury  Consider improving LOTO documentation and procedures, to include "Return To" position for valves/switches when placing equipment back in service.	75.1 1.1.1	S	6	PH A	Consider improving LOTO documentation and procedures, to include "Return To" position for valves/switches when placing equipment back in service.	Dave Curry	12/1/2010
21. Concern is inaccurate information presented on P&IDs.  Update Crude Unit / DEBRU P&IDs per PHA redlines.  Consider field validation of P&IDs to ensure that drawings accurately reflect as-found conditions of Crude Unit spools, blinds, utility connections.  Consider reviewing items listed from PHA spec break review and update P&IDs as needed.	75.2. 1.1 75.1 7.1.1 75.1 7.2.1			PH A PH A PH A	Update Crude Unit / DEBRU P&IDs per PHA redlines.  Consider field validation of P&IDs to ensure that drawings accurately reflect as-found conditions of Crude Unit spools, blinds, utility connections.  Consider reviewing items listed from PHA spec break review and update P&IDs as needed.	Ben Purvis	12/1/2010
22. Concern is that some items in control house not currently anchored (filing cabinets, vending machines)  Review control house furnishings to ensure proper anchoring in the event of blast or seismic event.	75.6. 1.1			PH A	Review control house furnishings to ensure proper anchoring in the event of blast or seismic event.	Kyle Drach	12/1/2010

Recommendations	Place(s) Used	Safety Category	Chevron PHA Risk Matrix	PHA / SOA	Resolution Plan	Assigned to:	Date Due
<p>23. Concern is that personnel on C-1100 or C-1160 have only one means of egress during an emergency (e.g., fire).</p> <p>Consider providing alternate means of safe egress from C-1100 or C-1160 during an emergency.</p>	75.1 3.1.1	S	6	PH A	Declined, secondary egress can be built based on work being performed.		

Recommendations	Place(s) Used	Severity Category	Chevron PHA Risk Matrix	PH A / SO A	Resolution Plan	Assigned to:	Date Due
24. Consider reviewing items listed from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PSI to reflect changes made.	75.1 7.1.1			PHA	<p>Reviewing items listed from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PSI to reflect changes made. Specific items as follows:</p> <p>D-308300: BA to A spec break between the P-1101A/B/C discharge piping and the wash oil header is inadequate. Action: Either roll out spools as designed or install blinds immediately downstream of the BA isolation valve.</p> <p>D-308305: TFI to AB0 and BA to AB0 spec breaks from E-1116A-F inlet/outlet to the pump out and wash oil headers are inadequate (typ 8) Action: Either roll out spools as designed or install blinds immediately downstream of the first block valve on the process piping (TF1 or BA). Recommend: We should consider upgrading these in the same manner as the PO/WO spools on the hot oil pumps in the plant were upgraded on the 2007 TA (double block and bleed of the higher pipe class).</p> <p>D-308309: BA to A spec break between the P-1128/A suction and the pump out header is not adequate. Action: Either roll out spools as designed or install blinds immediately downstream of the BA isolation valve.</p> <p>D-310483: TF1 to AF1/AB0 spec breaks between the K-1181/A/B Filters and the pump out and wash oil headers are inadequate. Action: Either roll out spools as designed, or install blinds immediately downstream of the TF1 isolation valve. Recommend: We should consider upgrading these in the same manner as the PO/WO spools on the hot oil pumps in the plant were upgraded (double block and bleed of the higher pipe class)</p>	Silvano Preciado	12/1/2010

Recommendations	Place(s) Used	Safety Category	Chevron PHA Risk Matrix	PHA / SOA	Resolution Plan	Assigned to:	Date Due
25. The following items on the list of in-house alarms appear to have incorrect labels:  42LC093 listed as "T3212 skimmed oil level", should be "V3212"  11TI404 listed as "4/5 s/c to tkn cold" should be "4/6"  11FI979 Listed as "8 s/c to E1164" but shown on dead leg on 30833800	75.2.2.1			PHA	Correct the following items on the list of in-house alarms:  42LC093 listed as "T3212 skimmed oil level", should be "V3212"  11TI404 listed as "4/5 s/c to tkn cold" should be "4/6"  11FI979 Listed as "8 s/c to E1164" but shown on dead leg on 30833800	Chuck Griffin	12/1/2010
26. Concern is loss of containment of demulsifier during truck unloading, with personnel exposure/environmental violation.  Consider developing a job aide for unloading demulsifier from truck.	12.1 3.1.1	S	7	PHA	Consider developing a job aide for unloading demulsifier from truck.	Silvano Preciado	12/1/2010
27. Concern is possibility of personnel injury while opening backup cooling water isolation valves for C-1160 overhead exchangers due to valve position in plant.  Consider reviewing accessibility of backup cooling water supply return valves for safe operation.	69.1. 2.1	S	7	PHA	Declined. Valve has been changed in field.		
28. Concern is that the combination of the currently-used seals on P-1195/A (C-1190 bottoms pump) with the current seal flush coolers may adversely impact pump reliability leading to unplanned shutdown.  Consider upgrading pump seals on P-1195/A (C-1190 bottoms pump) from API 21 to API 23 to improve reliability. Also consider upgrading seal flush coolers on P-1195/A (C-1190 bottoms pump) to improve efficiency.	7.1.1 .1	A	8	PHA	Declined. Seal upgrade is currently on work list and prioritized with other pump upgrades.		
29. Concern is that the vibration shutdowns currently used on fin fans (same on all) may be unreliable and may not shut down fans on high vibration.  Consider upgrade of current fin fan vibration shutdowns to a more reliable type to minimize equipment damage.	75.1 1.3.1	A	B	PHA	Declined. Vibration shutdown switches currently on work list.		

## **REVALIDATION PROCESS DESCRIPTION**

The revalidation was conducted in accordance with industry guidance found in the CCPS book "Revalidating Process Hazard Analyses". Three revalidation approaches are discussed and recommended:

- Update and Revalidate
- Retrofit, Update & Revalidate
- Redo.

This revalidation was completed utilizing the "Redo" alternative.

### **OBJECTIVES**

- Identify, understand and control the hazards associated with the current operation of the plant.
- Review and document the impact of all substantial changes to the plant during the period between PHA studies.
- Re-rank all scenarios with new risk matrix.

### **SCOPE**

- The revalidation is limited to on-plot operations and equipment associated with the plant.
- Provide a report using the existing PHA document as the foundation, or a new report if a redo was considered more appropriate.

The revalidation methodology included:

- The Team Leader provided an overview of PSM/PHA regulatory requirements.
- The team reviewed all open PHA Additional Considerations for completion. Implemented A/Cs were removed from the Recommendations column of the new worksheet, and added to the Safeguards column as a new safeguard.
- The risk ranking was revised, as appropriate, to recognize the risk mitigation provided by the safeguard.
- The team reviewed incidents (from the Refinery Incident Data Base and the Minor Incident Tracking System) that have occurred since the previous PHA revalidation study.
- The team reviewed all MOCs completed since the previous PHA revalidation study.
- The team reviewed all section descriptions and intentions of the PHA study. Revisions were noted in the Section Listing and Worksheets.
- The team reviewed, in detail, all portions of the previous PHA worksheets. Revisions were made accordingly and noted in the PHA worksheets.
- Operating hazards were discussed and issues were highlighted that the team determined needed to be addressed during the revalidation.
- Inspection concerns, operator concerns, engineering concerns, industry issues and reliability concerns were discussed.

## SUMMARY OF THE ORIGINAL AND REVALIDATION PHA TECHNIQUES

### *Brainstorm Concerns*

The PHA team brainstormed their concerns around the hazards of operations for each section. Some concerns discussed were highlighted during the pre-screening meeting.

### *Develop Potential Consequences*

For each unique concern, potential consequences were developed assuming there are no existing systems and procedures to prevent or mitigate the impact; no credit is given for operator training, equipment, or controls. The team was asked to develop the ultimate plausible potential consequences without the safeguards, looking as far upstream and downstream of the process section as possible. The following sixteen deviations were considered in each consequence: no/less flow, more flow, reverse flow, mis-directed flow, more temperature, less temperature, more pressure, less pressure, more level, less level, contamination, wrong concentration, startup/shutdown, leak/rupture, human factors, and miscellaneous. If no new causes were discovered within that node, the deviation was removed from the final document for readability purposes.

### *Identify Safeguards*

After each concern/consequence scenario was developed, the team was asked to list the existing systems and procedures to either prevent or mitigate the potential consequences. The team was asked to list these existing safeguards in the following order: (1) Systems and procedures that prevent the unique concern from occurring; (2) systems that alert the operator that abnormal conditions are developing; and (3) systems and procedures that mitigate the effects or consequences of the unique concern.

### *Consequence Assessment*

The PHA team members used the Chevron Integrated Risk Prioritization Matrix to qualitatively assess the risk associated with each concern/consequence scenario. After the consequences and safeguards were developed, the scenario was evaluated based on the perceived severity of the potential consequences, and the likelihood that the scenario would fully develop to those consequences. The severity ranking (1 to 6) and likelihood ranking (1 to 6) were combined using the risk ranking matrix to provide a qualitative risk ranking (1 to 10). Each developed concern/consequence scenario was given a qualitative risk ranking using this method.

For scenarios with risk ranking of 1, 2, 3 or 4, a short-term interim risk reduction plan is required and a long term permanent risk reduction plan must be developed and implemented.

For scenarios with a risk ranking of 5, long term risk reduction is required. If no further action can be reasonably taken, SBU management approval must be sought to continue the activity.

For scenarios with a risk ranking of 6, the risk is tolerable if reasonable safeguards and management systems are confirmed to be in place and consistent with relevant requirements of the risk mitigation closure guidelines in Chevron HES RiskMan2 Sub-Procedure 4.

For scenarios with a risk ranking of 7, 8, 9 or 10, no further risk reduction is required.

The PHA team was required to make suggestions they felt would eliminate the potential concern of the scenario or reduce the likelihood of the scenario fully developing to the ultimate consequences predicted for any scenarios risk ranked 1 - 5. Scenarios with a ranking of 6 - 10 were considered to be of tolerable risk. As a result, the need for further risk reduction was left to the discretion of the PHA team.

#### Recommendations

The Recommendations column of the PHA worksheets reflects the team's initial suggestions for reducing risk, and may not represent the only means for removing or mitigating the identified potential hazard. Further engineering evaluation may be necessary to determine what action best addresses the identified scenario; management should dictate follow-up action for these recommendations. Once an action plan has been developed by the business unit with owners and due dates they are entered into the Refinery Recommendation tracking database.

Scenarios with a risk ranking greater than 5 require the implementation of Inherently Safer Solutions *to the greatest extent feasible*.

#### Assumptions

1. Control set-points shown in the Consequence of Deviation (COD) worksheets are the same as the Critical Process Variables.
2. Equipment is inspected and tested in accordance with facility predictive and preventative maintenance standards and corrective maintenance is performed in a timely manner.
3. Relief valves are designed to relieve reasonable pressure surges and are in good working order. Block valves in inlet and exit piping to relief valves are locked open (LO or CSO) except for installed spare relief valves, which are intended to be isolated. Locked valves are procedurally managed in such a way as to provide a high degree of confidence that they are maintained in the intended position at all times and that required precautions are taken if their position must be changed during unit operation (e.g. for equipment maintenance or repair).
4. All valves shown on P&IDs as being locked open or closed are always in the position shown and procedurally managed in such a way as to provide a high degree of confidence that they are maintained in the intended position at all times. The team evaluates the consequences of failure in this practice when the potential consequences are judged to be severe.
5. Blinds and blind flanges do not leak.
6. Piping & Instrumentation Diagrams are correct.
7. Deviations resulting from two or more events occurring concurrently are not considered, unless one of the events has a high probability of occurring and the resulting consequences are severe.

Certain recognized non-process hazards, such as those listed below are outside the scope of this revalidation. These hazards are covered by other safety programs.

Electrical	Falling Objects	Electromagnetic Radiation
Hot Surfaces	Cryogenic Contact	Nuclear Radiation
Building Fires	Heat Stress	Non-Process Pressure/Flow (water lances, steam lances, compressed air)
Noise	Sharp Objects	Non-Process Explosion (compressed air cylinder rupture, etc.)

# PHA Findings

[Inside Home](#)
[People Finder](#)
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[tC, Seismic & ISS Findings](#)
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ABU	Plant	Revalidation	Start Date	End Date	Facilitator
D&R	#4 Crude Unit	2009	8/31/2009	11/17/2009	Mark Crow, C. Rene Murata
<b>Team Members / Role</b>					
Ben Purvis, Jacque Cartier			Ben Hulse, Dave Curry, Carl Simmers, Silvano Preciado, Gerald Lee		
<b>Additional Comments / Name</b>					
Reviewed By	Date	<b>Feedback/Comments</b>			

\* Further discussion about any portion of the report and its contents should be directed to the facilitator or any of the team members listed

[Entire PHA Report](#)

Section No	Section Description	Item WhatIf	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
1.1.2.1 17057	Crude Feed and Startup/Shutdown Piping, Including P-1101A/B/C through shell side of E-1101A/B/C/D, up to inlets of E-1104 and E-1102A/B/C.	No Flow	Concern is that operations may not have adequate time to respond to changes in feed composition. Reference MITS 2006-903 and MITS 2007-2144. Consider installation of an in-line gravity analyzer to indicate composition change in feed.	S	7	Declined, safeguards considered adequate for safety purposes. Under review as optimization item.	Declined, safeguards considered adequate for safety purposes. Under review as optimization item.	Curry, David P.	12/1/2010	Declined
1.1.2.1 17059	Contamination	Concern is that employees taking samples of desalter effluent may be	5	6	Modifications to V-1102 sample station in progress to mitigate			Preciado, Silvano E.	12/1/2010	In Progress

<http://ric841ntg3web10.ric841.chevronexaco.net/asphpha/PHASectionItem.asp?ABU=D626R&Plant=%234+Crude+Unit&vt=2...> 3/26/2010

exposed to H<sub>2</sub>S. Consider upgrading desalter effluent sample station to minimize chance of H<sub>2</sub>S exposure.

Concern is that MOV-023 may not close when signal is given either from the board or locally. This is an issue during both routine shutdowns and emergencies. Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed.

personnel exposure during sampling.  
Reference MOC 19520

Section No	Section Description		
Item	What if	Deviation	
		A/C	SOE RR ABU Proposal
12.2.2.1 17058	More Flow		5 6 Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed. Shutdown item: Aug 2011 TA.

Section No	Section Description		
Item	What if	Deviation	
		A/C	SOE RR ABU Proposal
12.12.1.1 17065	Startup/Shutdown Concern Is personnel exposure to benzene/H <sub>2</sub> S due to P-1106/A running during shutdown causing leak at a flange from overpressurization. Shutdown procedure 4CU-NP-3010 does not include demulsifying chemical pump shutdown. Add this to the procedure.		S 6 Shutdown procedure 4CU-NP-3010 does not include demulsifying chemical pump shutdown. Add this to the procedure.
12.13.1.1 17066	Leak/Rupture	Concern is loss of containment of demulsifier during truck unloading, with personnel exposure/environmental violation.	S 7 Consider developing a job aide for unloading demulsifier from truck.

Section No	Section Description		
Item	What if	Deviation	
		A/C	SOE RR ABU Proposal
13.1.1.1 17067	No Flow	Concern is that if PV-055 on aqueous ammonia recirculation line closes during normal operation, pressure increase may be sufficient to cause flange leak and release of aqueous ammonia to atmosphere. Consider evaluating aqueous ammonia injection pumps P-1108/A for	S 6 Confirm proper pipe rating in place for aqueous ammonia injection pumps P-1108/A and associated piping.

overpressure protection to prevent flange leaks and aqueous ammonia release when PV-055 closes.

Section No	Section Description								
Item	What If	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
14	Crude From E-1101A/B/C/D Through E-1102A/B/C, E-1103 and HIC-531.								
14.1.1.1 17068	No Flow	Concern is that neither primary nor secondary heat exchanger trains have adequate overpressure protection. Per BIM review: El Segundo has similar exchanger train design as Richmond, only El Segundo has overpressure protection. Consider review of overpressure protection for primary and secondary heat exchanger trains are adequate.	S	7	Review current overpressure protection for primary and secondary heat exchanger trains.		Purvis, Benjamin	12/1/2010	In Progress
<b>2</b> This section is the C-1100 overhead vapor train. It includes E-1101A/B/C/D tube sides, E-1100A/B/C/DEF, and V-1100.									
2.13.1.1 17060	Leak/Rupture	Concern is that existing corrosion probes are not routinely used to monitor corrosion rate in atmospheric column overhead. Review use of corrosion probes (awareness, maintenance, monitoring, etc.) in atmospheric column overhead.	S	6	Repair and commission remaining two corrosion probes (outlet) during next shutdown. Shutdown item: AUG 2011 TA.		Purvis, Benjamin	12/31/2011 Pending S/D	
# 1 Sidecut from C-1110 through P-1119/P-1129A, through E1103A/B to the JHT as hot feed or to E-1119 and then TK-679 (Cold Jet Tankage).									
31	ABU Proposal						Resolution	Owner	Due By
31.4.1.1 17069	Mis-Directed Flow	Concern is that line-ups to P-1129A suction and discharge are not clearly labeled in the field. This could result in the mis-manifolding of the pump. Applies to P-1149A and P-1189A.	A	7	Clearly label suction and discharge of p-1129A, p-1149A, p-1189A in the field.		Preciado, Silvano E.	12/1/2010	In Progress

Consider properly labeling suction and discharge of P-1129A, P-1149A, P-1189A in the field.

Section No	Section Description								
Item	Whatif	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
34	#8 s/c splits from VBCR at outlet of E-1116A-F through and including P-1189/A and E-1114 to RLOP (HNC/TKC). Also includes 8 side cut excess through E-1154E/F cell to RLOP cold feed.								
34.15.1.1 17071	Miscellaneous	Concern is that employee can be injured due to exposure to hot 8 side cut during sampling. Consider reviewing 8 side cut sample station to reduce potential for personnel injury.	S	7	Consider reviewing 8 side cut sample station to reduce potential for personnel injury.		Hulse, Benjamin	12/1/2010	In Progress

Section No	Section Description								
Item	Whatif	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
34.6.1.1 17070	Less Temperature	Concern is possibility of setting-up in 142 line (TKN cold tankage), especially during low ambient temperature conditions, and that there is no flow indication on this line. Consider adding a flow meter downstream of PC-984.	A	7	Consider adding a flow meter downstream of PC-984. Shutdown item: Aug 2011 IA.		Purvis, Benjamin	12/31/2011 Pending S/D	

Section No	Section Description								
Item	Whatif	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
4	Naphtha from V-1100 to Atmospheric Column overhead through pumps P-1100A/B/C. Includes export through V-1104, E-1195, and E-1185A/B to inlet of C-1100. Slipstream for corrosion inhibitor no longer used, blinded.								
4.1.1.1 17061	No Flow	Concern is that liquid carry-over to a compressor may cause equipment damage with loss of containment. An event occurred in 7-09 involving K-1171 for which a Taproot investigation is in progress (LI # 1564125). Ensure completion of the Taproot study and completion of any resulting corrective actions.	S	5	Ensure completion of the Taproot study (LI # 1564125) and completion of any resulting corrective actions.		Lee II, Gerald W.	12/1/2010	In Progress

Section No	Section Description								
Item	Whatif	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
44	Atmospheric column bottoms from P-1105/A through F-1160 to the inlet of C-1160.								

44.12.1.1.17072	Startup/Shutdown Concern is that loss of velocity steam during shutdown can result in backflow of crude into the steam system, causing possible valve damage, release of hot crude, and personnel injury. Check valve in line is not considered reliable.	S	6 Consider updating shutdown procedure to include blocking in velocity steam to furnace passes once steam generation system is shut down.	Carter III, 12/1/2010 In Progress Jacque-Michael S.
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Section No	Section Description								
Item	Whatif	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
45	Atmospheric column C-1100 and auxiliary piping.						Purvis, Benjamin	12/1/2010	In Progress
45.12.1.1.17073	Startup/Shutdown Concern is that C-1100/1160 level indication may not meet best practices. Consider review of best practices to determine if total level indication should be added to C-1100/1160.	A	6 Consider review of best practices to determine if total level indication should be added to C-1100/1160.				Carter III, 12/1/2010 In Progress Jacque-Michael S.		

Section No	Section Description								
Item	Whatif	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
46	Boller feed water and make-up through FV-444 through F-1100A/B and F-1160 to V-1177. Boller feedwater recycle from V-1177 through P-1177/A to E-1148, E-1178, E-1188, F-1160 and F-1100A/B and back to V-1177 as wet steam. Includes BFW, Superheated Steam to C-1100. Includes Steam drum V-1177 and auxiliary piping. Includes velocity steam for F-1160.	S	7 Review blowdown piping for V-1177, add routing to shutdown procedures and temporary piping list.				Carter III, 12/1/2010 In Progress Jacque-Michael S.		
46.12.1.1.17074	Startup/Shutdown Concern is personnel exposure to steam or hot condensate while blowing down V-1177 for level control during shutdowns and startups. Recommendation from 2004 PHA addresses 2006 shutdown, but states "Find other locations for future sids." Consider permanent blowdown piping for V-1177 routed to a process drain.	A/C							

Section No	Section Description			
http://ric841ntg3web10.ric841.chevronexaco.net/asphha/PHASection1tm.asp?ABU=D%26R&Plant=%234+Crude+Unit&vt=2... 3/26/2010				

6 Off-gas through K-1100A/B (first and second stages), including E-1169A/B and V-1169A/B, to inlet of C-1190 and spillback to C-1190 overhead. Includes V-1100A-1/3 suction damped and V-1100A-2/4 discharge dampener.

Item	WhatIf	Deviation	A/C	SOE	RR	ABU Proposal	Resolution	Owner	Due By	Status
6.4.1.1 17062	Mis-Directed Flow	Concern is that loss of nitrogen purge to K-1100s and K-1171s distance pieces could result in operator exposure to H2S/process gas. Consider adding flow indicator readings to handhelds.		S	6	Consider adding flow indicator readings to handhelds for nitrogen purge to K-1100s and K-1171s distance pieces.		Carter III, Jacques-Michael S.	12/1/2010	In Progress

#### Section No

#### Section Description

69 Cooling Water Towers E-3400, E-521 and pumps P-34C0/A. Also includes water from p-525A/B.

Item	WhatIf	Deviation	A/C	SOE	RR	ABU Proposal	Resolution	Owner	Due By	Status
69.1.2.1 17075	No Flow	Concern is possibility of personnel injury while opening backup cooling water isolation valves for C-1160 overhead exchangers due to valve position in plant. Consider reviewing accessibility of backup cooling water supply return valves for safe operation.		S	7	Declined. Backup cooling water isolation valves for C-1160 overhead exchangers have already been changed in the field to reduce the likelihood of operator injury while operating valves.	Declined. Backup cooling water isolation valves for C-1160 overhead exchangers have already been changed in the field to reduce the likelihood of operator injury while operating valves.	Curry, David P.	12/1/2010	Declined

#### Section No

#### Section Description

7 C-1190 Stabilizer and Auxiliary Piping and C-1190 Bottoms Through P-1195/A, E-1165/A/B, E-1195 to offplot to NHT or through E-1186 to the cold feed tanks for the NHT T-3197.

Item	WhatIf	Deviation	A/C	SOE	RR	ABU Proposal	Resolution	Owner	Due By	Status
7.1.1.1 17063	No Flow	Concern is that the combination of the currently-used seals on P-1195/A (C-1190 bottoms pump) with the current seal flush coolers may adversely impact pump reliability leading to unplanned shutdown. Consider upgrading pump seals on P-1195/A (C-1190 bottoms pump) from API 21 to API 23 to improve reliability. Also consider upgrading seal flush coolers on P-1195/A (C-1190 bottoms pump) to improve efficiency.		A	8	Declined. Not considered as a safety concern. Seal upgrade is currently on concern. Seal upgrade is currently on work list and prioritized with other pump upgrades to improve reliability.		Curry, David P.	12/1/2010	Declined

Section No	Section Description								
Item	What If	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
71		E-1164A/B/C/D. Includes # 4/6/7/8 sidecuts and resid through E-1164A/B/C/D to 10" off test or long loop to front of plant (PV-651).		S 7	Verify spec break and overpressure potential for E-1164s.		Hulse, Benjamin	12/1/2010	In Progress
71.12.1.1 17076	Startup/Shutdown	Concern is that E-1164A-F may not have sufficient protection for overpressure situations. Consider reviewing overpressure protection for E-1164A-F, particularly for long loop operations.					Carter III, Jacqueline-Michael S.	12/1/2010	In Progress

71.12.3.1 17077 Startup/Shutdown Concern is that the 10" block valve to tankage can be left open during long loop operations resulting in reverse flow of off-test material to crude unit, delaying startup/shutdown and causing loss of profit. Prior to the latest shutdown (07-09), no written long loop procedure existed. Consider establishing a written long loop procedure to ensure that the 10" valve to off-test tankage is not left open during long loop.

Section No	Section Description								
Item	What If	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
74	Startup/Shutdown Issues - Unit-wide			S 7	Consider revising list of PRDs in EOMs and on handhelds.		Carter III, Jacqueline-Michael S.	12/1/2010	In Progress

74.1.4.1 17078 Startup/Shutdown Concern is that current list of PRDs does not agree with EOMs or handhelds. Consider revising list of PRDs in EOMs and on handhelds.

Section No	Section Description								
Item	What If	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
75	"Wrap-up" Discussion of Issues General to the 4 CU Plant.			S 6	Consider Improving LOTO documentation and procedures, to include "Return To" position for valves/switches when placing equipment back in service.		Curry, David P.	12/1/2010	In Progress

75.11.1.1 17082 Other Issue Concern is that a valve may be left in improper position while placing equipment back in service, leading to loss of containment and personal injury. Consider improving LOTO documentation and procedures, to include "Return To"

75.11.3.1: 17083	Other Issue	Concern is that the vibration shutdowns currently used on fin fans (same on all) may be unreliable and may not shut down fans on high vibration. Consider upgrade of current fin fan vibration shutdowns to a more reliable type to minimize equipment damage.	A	8 Declined. Not considered as a safety concern. Vibration shutdown switches on fin fans currently on work list in an effort to improve reliability.	Declined. Not considered as a safety concern. Vibration shutdown switches on fin fans currently on work list in an effort to improve reliability.	Curry, David P.	12/1/2010 Declined
75.13.1.1: 17084	Miscellaneous	Concern is that personnel on C-1100 or C-1160 have only one means of egress during an emergency (e.g., fire). Consider providing alternate means of safe egress from C-1100 or C-1160 during an emergency.	S	6 Declined. secondary egress from C-1100 or C-1160 can be built as necessary based on work being performed.	Declined. secondary egress from C-1100 or C-1160 can be built as necessary based on work being performed.	Curry, David P.	12/1/2010 Declined
75.17.1.1: 17085	Other Issue	Consider reviewing items listed from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PSI to reflect changes made.		Reviewing items listed from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PSI to reflect changes made. Specific items as follows: D-308300; BA to A spec break between the P-1101A/B/C discharge piping and the wash oil header is inadequate. Action: Either roll out spools as designed or install blinds immediately downstream of the BA Isolation valve. D-308305; TF1 to ABO and BA to ABO spec breaks from E-1116A-F inlet/outlet to the pump out and wash oil headers are inadequate (typ 8) Action: Either roll out spools as designed or install blinds immediately downstream of the first block valve on the process piping (TF1 or BA). Recommend: We should consider upgrading these in the same manner as the PO/WO spools on the hot oil pumps. In the plant were upgraded on the 2007 TA (double block and bleed of the higher pipe class). D-308309; BA to A spec break between the P-1128/A suction and the pump out header is not adequate. Action: Either roll out spools as designed or install blinds immediately downstream of the BA isolation valve. D-310483; TF1 to		Preciado, Silvano E.	12/1/2010 In Progress

AFL/ABO spec breaks between the K-1181A/B Filters and the pump out and wash oil headers are inadequate. Action: Either roll out spools as designed, or install blinds immediately downstream of the TF1 isolation valve. Recommend: We should consider upgrading these in the same manner as the PQ/WO spools on the hot oil pumps in the plant were upgraded (double block and bleed of the higher pipe class). D-357210: BA to A spec break between the P1168/A discharge and the wash oil header is inadequate. Action: Either roll out spools as designed, or install blinds immediately downstream of the BA isolation valve.

Section No	Section Description	Item	What if	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
75.2.1.1 17079	General Issues			Update Crude Unit / DEBRU P&IDs per PHA redlines. Consider field validation of P&IDs to ensure that drawings accurately reflect as-found conditions of Crude Unit spools, blinds, utility connections. Consider reviewing items listed from PHA spec break review and update P&IDs as needed.				Point description for tag 42LC093 has been changed from "T3212 SKIMMED OIL LEVEL" to "V3212 SKIMMED OIL LEVEL"	Griffin, Charles T.	12/1/2010	In Progress
75.2.2.1 17080	General Issues			The following items on the list of In-house alarms appear to have incorrect labels: 42LC093 listed as "T3212 skinned oil level", should be "V3212" 11TI1404 listed as "4/5 s/c to tkn cold" should be "4/6" 11F1979 Listed as "8 s/c to E1164" but shown on dead leg on 30833800				Correct the following items on the list of in-house alarms: 42LC093 listed as "T3212 skinned oil level", should be "V3212" 11TI1404 listed as "4/6" "4/5 s/c to tkn cold" should be "4/6" 11F1979 Listed as "8 s/c to E1164" but shown on dead leg on 30833800	Drach, Kyle H.	12/1/2010	In Progress
75.6.1.1 17081	Facility/Equipment Sitting			Concern is that some items in control house not currently anchored (filing cabinets, vending machines) Review control house furnishings to ensure proper anchoring in the event of blast or seismic event.				Review control house furnishings to ensure proper anchoring in the event of blast or seismic event.			

8.15.2.1 17064 Miscellaneous Concern is personnel exposure to steam or hot condensate when C7-64 on V-1197 opens to atmosphere. Consider identifying area as potential steam hazard using RI-321 (Preventing Exposure to Corrosive Chemicals and Defining Yellow-Lined Areas)

5 6 Consider identifying area around C7-64 discharge as potential steam hazard.

Preciado, 12/1/2010 In Progress  
Silvano E.

Last Update: 4/10/2007  
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# PHA Findings

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ABU	Plant	Revalidation	Start Date	End Date	Facilitator
D&R	#4 Crude Unit	2009	8/31/2009	11/17/2009	Mark Crow, C. Rene Murata

## Team Members / Role

Ben Purvis, Jacqueline Carter

Additional Comments / Name

## Other Participants / Role

Ben Hulse, Dave Curry, Carl Simmers, Silvano Preciado, Gerald Lee

[Entire PHA Report](#)

\* Further discussion about any portion of the report and its contents should be directed to the facilitator or any of the team members listed

Reviewed By      Date      Feedback/Comments

Section No	Section Description	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
1	Crude Feed and Startup/Shutdown Piping, Including P-1101A/B/C through shell side of E-1101A/B/C/D, up to inlets of E-1104 and E-1102A/B/C.	A/C	Concern is that operations may not have adequate time to respond to changes in feed composition. Reference MITS 2006-903 and MITS 2007-2144. Consider installation of an in-line gravity analyzer to indicate composition change in feed.	S 7 Declined; safeguards considered adequate for safety purposes. Under review as optimization item.	Curry, David P.	12/1/2010	Declined
1.1.2.1 17057	No Flow						
1.11.2.1 17059	Containment			S 6 Modifications to V-1102 sample station in progress to mitigate concern is that employees taking samples of desalter effluent may be	Preciado, Silvano E.	12/1/2010	In Progress

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1.2.2.1 17058	More Flow	exposed to H2S. Consider upgrading desalter effluent sample station to minimize chance of H2S exposure. Concern is that MOV-023 may not close when signal is given either from the board or locally. This is an issue during both routine shutdowns and emergencies. Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed.	S	6	Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed. Shutdown item: Aug 2011 TA.	S	6	Consider upgrading desalter effluent sample station to minimize chance of H2S exposure. Reference MCC 19520	S	6	Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed. Shutdown item: Aug 2011 TA.	S	6	Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed. Shutdown item: Aug 2011 TA.
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Section No	Section Description			SOE RR			ABU Proposal			Resolution			Owner Due By Status			
Item	What If	Deviation	A/C													
12.12.1.1 17065	Startup/Shutdown	Concern is personnel exposure to benzene/H2S due to P-1106/A running during shutdown causing leak at a flange from overpressurization. Shutdown procedure 4CU-NP-3010 does not include demulsifying chemical pump shutdown. Add this to the procedure.	A/C	S	6	Shutdown procedure 4CU-NP-3010 does not include demulsifying chemical pump shutdown. Add this to the procedure.								Carter III, Jacques- Michael S.	12/1/2010	In Progress
12.13.1.1 17066	Leak/Rupture	Concern is loss of containment of demulsifier during truck unloading, with personnel exposure/environmental violation. Consider developing a job aide for unloading demulsifier from truck.	A/C	S	7	Consider developing a job aide for unloading demulsifier from truck.								Preciado, Silvano E.	12/1/2010	In Progress
13.1.1.1 17067	No Flow	Concern is that if PV-055 on aqueous ammonia recirculation line closes during normal operation, pressure increase may be sufficient to cause flange leak and release of aqueous ammonia to atmosphere. Consider evaluating aqueous ammonia injection pumps P-1108/A for	A/C	S	6	Confirm proper pipe rating in place for aqueous ammonia injection pumps P-1108/A and associated piping.								Hulse, Benjamin	12/1/2010	In Progress
13	Ammonia Injection Pumps P-1108/A and Aqueous Ammonia to C-1100 via the C-1110 overhead vapor line, and aqueous ammonia to C-1160. Includes T-1108. (Corrosion inhibition from corrosion inhibitor injection pumps P-1107, V-1107/A to C-1100 overhead line. Out of service)			SOE RR			ABU Proposal			Resolution			Owner Due By Status			

overpressure protection to prevent flange leaks and aqueous ammonia release when PV-055 closes.

Section No	Section Description									
	Item	What If	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
14			Crude From E-1101A/B/C/D Through E-1102A/B/C, E-1103 and HIC-531.					Purvis, Benjamin	12/1/2010	In Progress
14.1.1.1 17063		No Flow	Concern is that neither primary nor secondary heat exchanger trains have adequate overpressure protection. Per BIN review: El Segundo has similar exchanger train design as Richmond, only El Segundo has overpressure protection. Consider review of overpressure protection for primary and secondary heat exchanger trains are adequate.	S	7	Review current overpressure protection for primary and secondary heat exchanger trains.				
2			This section is the C-1100 overhead vapor train. It includes E-1101A/B/C/D tube sides, E-1100A/B/C/DE/F, and V-1100.							
2.13.1.1 17060		Leak/Rupture	Concern is that existing corrosion probes are not routinely used to monitor corrosion rate in atmospheric column overhead. Review use of corrosion probes (awareness, maintenance, monitoring, etc.) in atmospheric column overhead.	A/C	S	Repair and commission remaining two corrosion probes (outlet) during next shutdown. Shutdown item: Aug 2011 TA.		Purvis, Benjamin	12/31/2011 Pending S/D	
31			#1 Sideload from C-1110 through P-1119/1129A, through E1105A/B to the JHT as hot feed or to E-1119 and then TK-079 (Cold Jet Tankage).					Preciado, Silvano E.	12/1/2010	In Progress
31.4.1.1 17069		Mis-Directed Flow	Concern is that line-ups to P-1129A suction and discharge are not clearly labeled in the field. This could result in the mis-manifolding of the pump. Applies to P-1149A and P-1189A.	A/C	7	Clearly label suction and discharge of P-1129A, P-1149A, P-1189A in the field.				

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Consider property labeling suction  
and discharge of P-1129A, P-1149A,  
P-1189A in the field.

Section No		Section Description						
Item	WhatIf	Deviation	A/C					
			SOE RR					
34	#8 S/c splits from VBCR at outlet of E-1116A-F through and including P-1189/A and E-1114 to RLOP (HNC/IKC). Also includes 8 side cut excess through E-1164E/F cell to RLOP cold feed.		ABU Proposal					
34.15.1.1.1 17071	Miscellaneous	Concern is that employee can be injured due to exposure to hot 8 side cut during sampling. Consider reviewing 8 side cut sample station to reduce potential for personnel injury.	S 7	Consider reviewing 8 side cut sample station to reduce potential for personnel injury.	Resolution	Owner	Due By	Status
34.6.1.1 17070	Less Temperature	Concern is possibility of settling-up in 142 line (TKN cold tankage), especially during low ambient temperature conditions, and that there is no flow indication on this line. Consider adding a flow meter downstream of PC-984.	A 7	Consider adding a flow meter downstream of PC-984. Shutdown item: Aug 2011 TA.	Purvis, Benjamin	12/1/2010	In Progress	

Section No		Section Description							
Item	WhatIf	Deviation	A/C						
			SOE RR						
4	Naphtha from V-1109 to Atmospheric Column overhead through pumps P-1100A/B/C. Includes export through V-1104, E-1195, and E-1185A/B to inlet of C-1190. Slipstream for corrosion inhibitor no longer used, blinded.		ABU Proposal						
4.1.1.1.1 17051	No Flow	Concern is that liquid carryover to a compressor may cause equipment damage with loss of containment. An event occurred in 7-09 involving K-1171 for which a Taproot investigation is in progress (LI # 1564125). Ensure completion of the Taproot study and completion of any resulting corrective actions.	S 5	Ensure completion of the Taproot study (LI # 1564125) and completion of any resulting corrective actions.	Resolution	Owner	Due By	Status	
44	Atmospheric column bottoms from P-1105/A through F-1160 to the inlet of C-1160.		ABU Proposal						
Item	WhatIf	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status

## Chevron Products Company

<b>44.12.1.1 17072</b>	<b>Startup/Shutdown</b> Concern is that loss of velocity steam during shutdown can result in backflow of crude into the steam system, causing possible valve damage, release of hot crude, and personnel injury. Check valve in line is not considered a reliable safeguard. Consider updating shutdown procedure to include blocking in velocity stream to furnace passes once steam generation passes once steam generation System is shut down.	<b>5</b>	<b>6</b> Consider updating shutdown procedure to include blocking in velocity steam to furnace passes once steam generation system is shut down.	<b>Carter III,</b> <b>Jacque-</b> <b>Michael S.</b>	<b>12/1/2010</b> <b>In Progress.</b>
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<b>Section No</b>	<b>Section Description</b>							
<b>Item</b>	<b>WhatIf</b>	<b>Deviation</b>	<b>SOE RR</b>	<b>ABU Proposal</b>	<b>Resolution</b>	<b>Owner</b>	<b>Due By</b>	<b>Status</b>
<b>45</b>		Atmospheric column C-1100 and auxiliary piping.	<b>A/C</b>	<b>6</b> Consider review of best practices to determine if total level indication should be added to C-1100/1160.	<b>Purvis,</b> <b>Benjamin</b>	<b>12/1/2010</b> <b>In Progress.</b>		
<b>45.12.1.1 17073</b>	<b>Startup/Shutdown</b> Concern is that C-1100/1160 level Indication may not meet best practices. Consider review of best practices to determine if total level indication should be added to C-1100/1160.							
<b>46</b>		Boiler feed water and make-up through FV-444 through F-1100A/B and F-1160 to V-1177 as wet steam. Includes BWV, Superheated Steam to C-1100. Includes Steam drum V-1177 and auxiliary piping. Includes velocity steam for F-1160.	<b>A/C</b>	<b>7</b> Review blowdown piping for V-1177, add routing to shutdown procedures and temporary piping list.	<b>Carter III,</b> <b>Jacque-</b> <b>Michael S.</b>	<b>12/1/2010</b> <b>In Progress.</b>		
<b>46.12.1.1 17074</b>	<b>Startup/Shutdown</b> Concern is personnel exposure to steam or hot condensate while blowing down V-1177 for level control during shutdowns and startups. Recommendation from 2004 PHA addresses 2006 shutdown, but states "Find other locations for future s/d/s" Consider permanent blowdown piping for V-1177 routed to a process drain.							

<b>Section No</b>	<b>Section Description</b>				

6 Off-gas through K-1100A/B (first and second stages), including E-1169A/B and V-1169A/B, to inlet of C-1190 and spillback to C-1100 overhead. Includes V-1100A-1/3 suction damped and V-1100A-2/4 discharge damper.

Item	WhatIf	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
6.4.1.1 17062	Mis-Directed Flow	Concern is that loss of nitrogen purge to K-1100s and K-1171s distance pieces could result in operator exposure to H2S/process gas. Consider adding flow indicator readings to handfields.	S 6	Consider adding flow indicator readings to handfields for nitrogen purge to K-1100s and K-1171s distance pieces.		Carter III, Jacqueline-Michael S.	12/1/2010	In Progress	

#### Section No

#### Section Description

69 Cooling Water Towers E-3400, E-521 and pumps P-3400/A. Also includes water from P-526A/B.

Item	WhatIf	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
69.1.2.1 17075	No Flow	Concern is possibility of personnel injury while opening backup cooling water isolation valves for C-1160 overhead exchangers due to valve position n plant. Consider reviewing accessibility of backup cooling water supply return valves for safe operation.	S 7	Declined. Backup cooling water isolation valves for C-1160 overhead exchangers have already been changed in the field to reduce the likelihood of operator injury while operating valves.	Declined. Backup cooling water isolation valves for C-1160 overhead exchangers have already been changed in the field to reduce the likelihood of operator injury while operating valves.	Curry, David P.	12/1/2010	Declined	

#### Section No

#### Section Description

7 C-1190 Stabilizer and Auxiliary Piping and C-1190 Bottoms Through P-1195/A, E-1165A/B, E-1195 to offplot to NH<sub>3</sub> or through E-1186 to the cold feed tanks for the NHT T-3197.

Item	WhatIf	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
7.1.1.1 17063	No Flow	Concern is that the combination of the currently used seals on P-1195/A (C-1190 bottoms pump) with the current seal flush coolers may adversely impact pump reliability leading to unplanned shutdown. Consider upgrading pump seals on P-1195/A (C-1190 bottoms pump) from API 21 to API 23 to improve reliability. Also consider upgrading seal flush coolers on P-1195/A (C-1190 bottoms pump) to improve efficiency.	A 8	Declined. Not considered as a safety concern. Seal upgrade is currently on concern. Seal upgrade is currently on other work list and prioritized with other pump upgrades to improve reliability.		Declined. Not considered as a safety concern. Seal upgrade is currently on concern. Seal upgrade is currently on other work list and prioritized with other pump upgrades to improve reliability.	Curry, David P.	12/1/2010	Declined

Section No	Section Description	Item	What If	Deviation	A/C	SOE RR	ABU Proposal	Resolution	Owner	Due By	Status
71	E-1164A/B/C/D. Includes # 4/6/7/8 sidecuts and resid through E-1164A/B/C/D to 10" off-test or long loop to front of plant (PV-651).					S 7	Verify spec break and overpressure potential for E-1164s.		Huise, Benjamin	12/1/2010	In Progress.
71.12.1.1 17076	Startup/Shutdown Concern is that E-1164A-F may not have sufficient protection for overpressure situations. Consider reviewing overpressure protection for E-1164A-F, particularly for long loop operations.								Carter III, Jacques-Michael S.	12/1/2010	In Progress.
71.12.3.1 17077	Startup/Shutdown Concern is that the 10" block valve to tankage can be left open during long loop operations resulting in reverse flow of off-test material to crude unit, delaying startup/shutdown and causing loss of profit. Prior to the latest shutdown (07-09), no written long loop procedure existed. Consider establishing written long loop procedure to ensure that the 10" valve to off-test tankage is not left open during long loop.				A 6	Consider establishing a written long loop procedure to ensure that the 10" valve to off-test tankage is not left open during long loop.					
74	Startup/Shutdown Issues - Unit-wide										
74.14.1 17078	Startup/Shutdown Concern is that current list of PRDs does not agree with EOMs or handhelds. Consider revising list of PRDs in EOMs and on handhelds.				A/C	SOE RR	ABU Proposal	Resolution	Carter III, Jacques-Michael S.	12/1/2010	In Progress.
75	"Wrap-up" Discussion of Issues General to the 4 CU Plant.										
75.11.1.1 17082	Other issue				S 6	Concern is that a valve may be left in improper position while placing equipment back in service, leading to loss of containment and personnel injury. Consider improving LOTO documentation and procedures, to include "Return To"	ABU Proposal	Resolution	Curry, David P.	12/1/2010	In Progress.

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75.11.3.1.17083	Other Issue	Concern is that valves/switches when placing equipment back in service.	A	B Declined. Not considered as a safety concern. Concern: vibration shutdown switches on fin fans currently on work list in an effort to improve reliability.	Declined. Not considered as a safety concern. Concern: vibration shutdown switches on fin fans currently on work list in an effort to improve reliability.	Curry, David P.	12/1/2010 Declined
75.13.1.1.17084	Miscellaneous	Concern is that personnel on C-1100 or C-1160 have only one means of egress during an emergency (e.g., fire). Consider providing alternate means of safe egress from C-1100 or C-1160 during an emergency.	S	6 Declined, secondary egress from C-1100 or C-1160 can be built as necessary based on work being performed.	Declined, secondary egress from C-1100 or C-1160 can be built as necessary based on work being performed.	Curry, David P.	12/1/2010 Declined
75.17.1.1.17085	Other Issue	Consider reviewing items listed from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PS1 to reflect changes made.		Reviewing items listed from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PS1 to reflect changes made. Specific items as follows: D-308300: BA to A spec break between the P-1101A/B/C discharge piping and the wash oil header is inadequate. Action: Either roll out spools as designed or install blinds immediately downstream of the BA isolation valve. D-308305: TF1 to ABO and BA to ABO spec breaks from E-1116A-F inlet/outlet to the pump out and wash oil headers are inadequate (typ B) Action: Either roll out spools as designed or install blinds	Preciado, Silvano E.	12/1/2010 In Progress	
		Immediately downstream of the first block valve on the process piping (TF1 or BA). Recommend: We should consider upgrading these in the same manner as the PO/WO spools on the hot oil pumps in the plant were upgraded on the 2007 TA (double block and bleed of the higher pipe class). D-308309: BA to A spec break between the P-1128/A suction and the pump out header is not adequate. Action: Either roll out spools as designed or install blinds immediately downstream of the BA isolation valve. D-310483: TF1 to					

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AF1/ABD spec breaks between the K-118LA/B Filters and the pump out and wash oil headers are inadequate. Action: Either roll out spools as designed, or install blinds immediately downstream of the TF1 isolation valve. Recommend: We should consider upgrading these in the same manner as the PQ/WO spools on the hot oil pumps. In the plant were upgraded (double block and bleed of the higher pipe class).

D-357210: BA to A spec break between the P1168/H discharge and the wash oil header is inadequate. Action: Either roll out spools as designed, or install blinds immediately downstream of the BA isolation valve.

Update Crude Unit / DEBRU P&IDs per PHA redlines. Consider field validation of P&IDs to ensure that drawings accurately reflect as-found conditions of Crude Unit spools, blinds, utility connections. Consider reviewing items listed from PHA spec break review and update P&IDs as needed.

Correct the following items on the list of in-house alarms: 42LC093 listed as "T3212 skinned oil level", should be "V3212" 11T1404 listed as "4/5 S/c to Ekn cold" should be "4/6" 11T1979 Listed as "8 s/c to E1164" but shown on dead leg on 30833800

Review control house furnishings to ensure proper anchoring in the event of blast or seismic event.

Section No	Section Description	Resolution						
8	C-1190 bottoms through stabilizer reboilers E-1197A/B. Includes stabilizer reboiler drain and condensate drum V-1197.							
Item	What if	Deviation	A/C	SOE RR	ABU Proposal	Owner	Due By	Status
75.2.1.1 17079	General Issues	Update Crude Unit / DEBRU P&IDs per PHA redlines. Consider field validation of P&IDs to ensure that drawings accurately reflect as-found conditions of Crude Unit spools, blinds, utility connections. Consider reviewing items listed from PHA spec break review and update P&IDs as needed.	Purvis, Benjamin	12/1/2010 In Progress				
75.2.2.1 17080	General Issues	The following items on the list of in-house alarms appear to have incorrect labels: 42LC093 listed as "T3212 skinned oil level", should be "V3212" 11T1404 listed as "4/5 S/c to Ekn cold" should be "4/6" 11T1979 Listed as "8 s/c to E1164" but shown on dead leg on 30833800	Point description for tag 42LC093 Has been changed from "T3212 SKIMMED OIL LEVEL" to "V3212 SKIMMED OIL LEVEL"	Griffin, Charles T.	12/1/2010 In Progress			
75.6.1.1 17081	Facility/Equipment Concern	Sitting	Review control house furnishings to ensure proper anchoring in the event of blast or seismic event.	Drach, Kyle H.	12/1/2010 In Progress			

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8.15.2.1.17064	Miscellaneous	Concern is personnel exposure to steam or hot condensate when C7-64 on V-1197 opens to atmosphere. Consider identifying area as potential steam hazard using RI-321 (Preventing Exposure to Corrosive Chemicals and Defining Yellow-Listed Areas)	S	6 Consider identifying area around C7-64 discharge as potential steam hazard.	Preciado, Silvano E. In Progress
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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17057	D&R	#4 Crude Unit	2009	1.1.2.1	Concern is that operations may not have adequate time to respond to changes in feed composition. Reference MITS 2006-903 and MITS 2007-2144.  Consider installation of an in-line gravity analyzer to indicate composition change in feed.	Declined, safeguards considered adequate for safety purposes. Under review as optimization item.	Declined, safeguards considered adequate for safety purposes. Under review as optimization item.			12/1/2010	7	S	Curry, David P.	Declined	
17058	D&R	#4 Crude Unit	2009	1.2.2.1	Concern is that MOV-023 may not close when signal is given either from the board or locally. This is an issue during both routine shutdowns and emergencies.  Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed.	Consider improving the reliability of remote operation of MOV-023 to ensure that MOV-023 closes when needed.  Shutdown item: Aug 2011 TA.	status 3/24/11 siph - verified is complete on s/d work list EWO BE603-01 line item 009. work completed during t/a.	QA/QC Signed off repair completed on T/A. 320827-001BE603-01 Crude Feed MOV EBV List Stroke and repair if needed.BE603-01Signed Off BySign Off DateExecuted ByCraftQC DocumentDoc StatusChevron InstrLoop CheckSigned Offct\dmqq11/9/2011 12:00:00AM	Curry, David P.	1/19/2012	1/31/2012	6	S	Preciado, Silvano E.	Completed
17059	D&R	#4 Crude Unit	2009	1.11.2.1	Concern is that employees taking samples of desalter effluent may be exposed to H2S.  Consider upgrading desalter effluent sample station to minimize chance of H2S exposure.	Modifications to V-1102 sample station in progress to mitigate personnel exposure during sampling. Reference MOC 19520	Sample station modifications have been completed for detail see MOC and EWO attachments. Summary of changes; throttle valve added to control flow through cooler, temp and pressure gages to monitor sample conditions, replaced/resized eductor to draw vapors away from operator and sample box reconditioned.	Modifications verified to be complete per MOC# 19520	Beatham, Keith	9/8/2010	12/1/2010	6	S	Preciado, Silvano E.	Completed

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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17060	D&R	#4 Crude Unit	2009	2.13.1.1	Concern is that existing corrosion probes are not routinely used to monitor corrosion rate in atmospheric column overhead.  Review use of corrosion probes (awareness, maintenance, monitoring, etc.) in atmospheric column overhead.	Repair and commission remaining two corrosion probes (outlet) during next shutdown.  Shutdown item: Aug 2011 TA.	This item is addressed as long as the E-1101 outlet corrosion probes are installed next shutdown. The following numbers can be used to track job completion: •EWO #BE132-11 on the shutdown worklist •Maximo #320820-001  These probes are routinely monitored by Nalco for signs of corrosion. We frequently replace the inlet probes. The outlet probes, on the other hand, cannot be replaced on the run so they will change during the shutdown. This item is on the shutdown worklist for the 2011 4CU major.  Beyond the corrosion probes, we monitor several other variables to watch for overhead corrosion. Nalco takes routine iron samples in the water; PED monitors NH4Cl sublimation temperatures, water dew point temperatures, and overhead chlorides; and Inspection checks the piping every 3 years per API recommendation.  Status 1/19/12 Mark Crow (MXEW) per Ben Purvis: The outlet probes of E-1101 were replaced during the 2011 4CU major turnaround under EWO 13211 and Maximo 320820-001. All actions required to complete this action item have been completed. No further follow up necessary.	work completed on t/a Instrumentation 1100.00%320820- 001BE132-I1 C1100 OVHD Corrosion Probes ReplacementBE13 2-I1Signed Off BySign Off DateExecuted ByCraftQC DocumentDoc StatusInspectionsL oop CheckSigned Offct\dmqq	Preciado, Silvano E.	1/20/2012	1/31/2012	6	S	Purvis, Benjamin	Completed

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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17061	D&R	#4 Crude Unit	2009	4.1.1.1	Concern is that liquid carryover to a compressor may cause equipment damage with loss of containment. An event occurred in 7-09 involving K-1171 for which a Taproot investigation is in progress (LI # 1564125).	Ensure completion of the Taproot study (LI # 1564125) and completion of any resulting corrective actions.	Revised 4CU start up procedure to create stand alone procedures for starting up K1100's and 1171's. Reference 4CU MOC # 22707, procedure 2090 (Prepare Vent Gas Compressors K1171/A and Degasser V1175 for startup), and procedure 2095 (Startup Vent Gas Compressors K1171/A).	Checked EOM verified procedure is posted.	Preciado, Silvano E.	11/8/2010	12/1/2010	5	S	Lee II, Gerald W.	Completed
17062	D&R	#4 Crude Unit	2009	6.4.1.1	Concern is that loss of nitrogen purge to K-1100s and K-1171s distance pieces could result in operator exposure to H2S/process gas.	Consider adding flow indicator readings to handhelds for nitrogen purge to K-1100s and K-1171s distance pieces.	Reassigned from Jaque Cartier to Keith Beatham on 10/3/10.	Confirmed change with Inteletrak coordinator	Preciado, Silvano E.	11/10/2010	12/1/2010	6	S	Beatham, Keith	Completed
7063	D&R	#4 Crude Unit	2009	7.1.1.1	Concern is that the combination of the currently-used seals on P-1195/A (C-1190 bottoms pump) with the current seal flush coolers may adversely impact pump reliability leading to unplanned shutdown.	Declined. Not considered as a safety concern. Seal upgrade is currently on work list and prioritized with other pump upgrades to improve reliability.	Declined. Not considered as a safety concern. Seal upgrade is currently on work list and prioritized with other pump upgrades to improve reliability.			12/1/2010	8	A		Curry, David P.	Declined
17064	D&R	#4 Crude Unit	2009	8.15.2.1	Concern is personnel exposure to steam or hot condensate when C7-64 on V-1197 opens to atmosphere.	Consider identifying area around C7-64 discharge as potential steam hazard.	Two signs posted at base of vessel.	signs posted at base of vessel confirmed	Beatham, Keith	11/19/2010	12/1/2010	6	S	Preciado, Silvano E.	Completed
					Consider identifying area as potential steam hazard using RI-321 (Preventing Exposure to Corrosive Chemicals and Defining Yellow-Lined Areas)										

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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17065	D&R	#4 Crude Unit	2009	12.12.1.	Concern is personnel exposure to 1 benzene/H2S due to P-1106/A running during shutdown causing leak at a flange from overpressurization.	Shutdown procedure 4CU-NP-3010 does not include demulsifying chemical pump shutdown. Add this to the procedure.  Shutdown procedure 4CU-NP-3010 does not include demulsifying chemical pump shutdown. Add this to the procedure.	Instruction to shutdown pump was added se step 9.21	Shutdown procedure NP-3010 was converted to NP-3000. Step 9.21 is verified to have added shutting down P1106/A.	Beatham, Keith	9/8/2010	12/1/2010	6	S	Preciado, Silvano E.	Completed
17066	D&R	#4 Crude Unit	2009	12.13.1.	Concern is loss of containment of 1 demulsifier during truck unloading, with personnel exposure/environmental violation.	Consider developing a job aide for unloading demulsifier from truck.  Consider developing a job aide for unloading demulsifier from truck.	The following job aid has been written and is posted to EOM web (4CU4780j).	Posted to web	O'Neill, Patrick P.	11/22/2010	12/1/2010	7	S	Preciado, Silvano E.	Completed
17067	D&R	#4 Crude Unit	2009	13.1.1.1	Concern is that if PV-055 on aqueous ammonia recirculation line closes during normal operation, pressure increase may be sufficient to cause flange leak and release of aqueous ammonia to atmosphere.	Confirm proper pipe rating in place for aqueous ammonia injection pumps P-1108/A and associated piping.  Consider evaluating aqueous ammonia injection pumps P-1108/A for overpressure protection to prevent flange leaks and aqueous ammonia release when PV-055 closes.	Reassigned from Ben Hulse to Kurt Gish on 6/14/10.  Piping has been evaluated and it is rated above the full discharge pressure of P-1108's.	Pipe class evaluation is correct. Orig class of construction "A" (Braun 4 Crude) translates to Richmond Class ABO or to corporate Class 1CS12. All of these are appropriate for Aqueous Ammonia at pressures up to 285 psi	Post, Ronald W.	11/5/2010	12/1/2010	6	S	Gish, Kurt E.	Completed

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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17068	D&R	#4 Crude Unit	2009	14.1.1.1	Concern is that neither primary nor secondary heat exchanger trains have adequate overpressure protection.	Review current overpressure protection for primary and secondary heat exchanger trains.  Per BIN review: El Segundo has similar exchanger train design as Richmond, only El Segundo has overpressure protection.  Consider review of overpressure protection for primary and secondary heat exchanger trains are adequate.	Prior to the 2007 shutdown, the primary and secondary trains were both studied for whether or not they had adequate overpressure protection. As a result, level controller 11LV054 was moved from just upstream of the desalter to all the way upstream of the primary train. Now, the primary train can release to the desalter, which has a safety, in the event of an overpressure situation.  The secondary train can empty through F-1100A/B into C-1100 which has a safety. Therefore, the overpressure protection of both preheat trains is adequate.	Redundant PRD's on desalter; PV11652 lifts at 242lbs and PV11653 250lbs	Preciado, Silvano E.	11/7/2010	12/1/2010	7	S	Purvis, Benjamin	Completed
17069	D&R	#4 Crude Unit	2009	31.4.1.1	Concern is that line-ups to P-1129A suction and discharge are not clearly labeled in the field. This could result in the mis-manifolding of the pump. Applies to P-1149A and P-1189A.	Clearly label suction and discharge of P-1129A, P-1149A, P-1189A in the field.  Consider properly labeling suction and discharge of P-1129A, P-1149A, P-1189A in the field.	OMC has installed labels on suction piping to identify product line.	Labels affixed	Beatham, Keith	11/2/2010	12/1/2010	7	A	Preciado, Silvano E.	Completed

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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17070	D&R	#4 Crude Unit	2009	34.6.1.1	Concern is possibility of setting-up in 142 line (TKN cold tankage), especially during low ambient temperature conditions, and that there is no flow indication on this line.	Consider adding a flow meter downstream of PC-984.  Shutdown item: Aug 2011 TA.  Consider adding a flow meter downstream of PC-984.	PED does not recommend adding a flow meter for the following reasons: -There is adequate indication to make sure there is flow in that line including temperature indication, valve position indication, and other flow meters in the system. -Even if product does set up, it is not a significant issue (i.e. not safety or environmental hazard). The only result would be product downgrade, but not enough to justify the cost of adding a meter. -There are steam coils in the fin-fans which are used to prevent material from setting up.	Operations is in agreement with PED reco this would cause product loss of 8 side cut to resid until corrected.	Preciado, Silvano E.	10/29/2010	12/31/2011	7	A	Purvis, Benjamin	Completed
17071	D&R	#4 Crude Unit	2009	34.15.1.	Concern is that employee can be injured due to exposure to hot 8 side cut during sampling.	Consider reviewing 8 side cut sample station to reduce potential for personnel injury.  Consider reviewing 8 side cut sample station to reduce potential for personnel injury.	11/11 GISH ~ Needle valve has been installed and tested by operations personnel and has been found to be an adequate mediation of the risk.  Reassigned from Ben Hulse to Kurt Gish on 6/14/10.  - A needle valve is being added for better control of the sample point. Expected completion is 11/15/10.	Job completed plant operator confirmed operation	Preciado, Silvano E.	11/11/2010	12/1/2010	7	S	Gish, Kurt E.	Completed

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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17072	D&R	#4 Crude Unit	2009	44.12.1.	Concern is that loss of velocity steam during shutdown can result in backflow of crude into the steam system, causing possible valve damage, release of hot crude, and personnel injury. Check valve in line is not considered a reliable safeguard.	Consider updating shutdown procedure to include blocking in velocity steam to furnace passes once steam generation system is shut down.	Reassigned from Jaque Cartier to Keith Beatham on 10/3/10. Status 11/5/2010, Mark Crow (MXEW): Per Keith Beatham, Exapilot 4 C/U shutdown procedure#3000 step 7.6, 7.7 has been updated to include when steam source is blinded and or blocked in to ensure that velocity steam is B/I. This will mitigate the potential for crude from entering the steam system via this velocity steam line during shutdown conditions.	Procedure revised, was part of discussion with DED that concluded piping configuration was acceptable.	Preciado, Silvano E.	1/19/2012	1/31/2012	6	S	Beatham, Keith	Completed
17073	D&R	#4 Crude Unit	2009	45.12.1.	Concern is that C-1100/1160 level indication may not meet best practices.	Consider review of best practices to determine if total level indication should be added to C-1100/1160.	There is adequate total level indication on C-1160 per the best practice.	Operations is in agreement with PED review, there are additional indicators such as the RAMS-HORN and pump suction pressure.	Preciado, Silvano E.	10/29/2010	12/1/2010	6	A	Purvis, Benjamin	Completed
					Consider review of best practices to determine if total level indication should be added to C-1100/1160.		Best practice does not require total level indication on C-1100, so that does not need to be added at this time.								

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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17074	D&R	#4 Crude Unit	2009	46.12.1.	Concern is personnel exposure to 1 steam or hot condensate while blowing down V-1177 for level control during shutdowns and startups.	Review blowdown piping for V-1177, add routing to shutdown procedures and temporary piping list.  Recommendation from 2004 PHA addresses 2006 shutdown, but states "Find other locations for future s/d's"  Consider permanent blowdown piping for V-1177 routed to a process drain.	Location of cleanup piping has been changed on cleanup procedures and also noted in turnaround database.	Temp connection piping has been updated new record #22816 to address routing to drain	Preciado, Silvano E.	11/7/2010	12/1/2010	7	S	Beatham, Keith	Completed
17075	D&R	#4 Crude Unit	2009	69.1.2.1	Concern is possibility of personnel injury while opening backup cooling water isolation valves for C-1160 overhead exchangers due to valve position in plant.	Declined. Backup cooling water isolation valves for C-1160 overhead exchangers have already been changed in the field to reduce the likelihood of operator injury while operating valves.  Consider reviewing accessibility of backup cooling water supply return valves for safe operation.	Declined. Backup cooling water isolation valves for C-1160 overhead exchangers have already been changed in the field to reduce the likelihood of operator injury while operating valves.			12/1/2010	7	S	Curry, David P.	Declined	

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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17076	D&R	#4 Crude Unit	2009	71.12.1.	Concern is that E-1164A-F may not have sufficient protection for overpressure situations.	Verify spec break and overpressure potential for E-1164s. Consider reviewing overpressure protection for E-1164A-F, particularly for long loop operations.	1/19/2012 ~ All work complete and all drawing have been updated per MOC 24008 (MOC has not been completed, but all drawings have been updated).  9/29/11 ~ EWO is nearly complete and work has been planned. The work will occur during the Major Shutdown and will be ready to operate upon unit start-up in Mid November.  11/4/10 ~ GISH The installation of a PRD on the E-1164 E & F outlet was discussed during a meeting 11/3/10, and it was determined that the system could not be isolated and work performed safely "on-the-run" (attending the meeting: Kurt Gish, Dave Curry, Sil Preciado, John Perone, Greg Hintz). This item will be completed during the 2011 shutdown.  Reassigned from Ben Hulse to Kurt Gish on 6/14/10.	job completed on shutdown  BE141-E1 Install new PRD C7-156 see ewo BE141-E2 for Hot TapBE141-E1Signed Off BySign Off DateExecuted ByCraftQC DocumentDoc StatusTimecJob Completion FormSigned Offct\mzqg11/3/2 011  12:00:00AMContr a Costa InstrumentTubing AssemblySigned Offct\mzqg11/11/2011  12:00:00AMBay ValveMachinist707 ASigned Offct\mzqg11/10/2011  12:00:00AMTimec Flange AssemblySigned Offct\mzqg11/3/2 011  12:00:00AMWorld Wide WeldingWeld PackageSigned Offct\gcgf	Preciado, Silvano E.	1/20/2012	1/31/2012	7	S	Gish, Kurt E.	Completed

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Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17077	D&R	#4 Crude Unit	2009	71.12.3.	Concern is that the 10" block valve 1 to tankge can be left open during long loop operations resulting in reverse flow of off-test material to crude unit, delaying startup/shutdown and causing loss of profit. Prior to the latest shutdown (07-09), no written long loop procedure existed.	Consider establishing a written long loop procedure to ensure that the 10" valve to off-test tankage is not left open during long loop.	Reassigned from Jaque Cartier to Keith Beatham on 10/3/10. current procedure adequate, procedure updated to monitor levels to ensure no backflow from offtest tankage.	step added in procedure 4CUXN3000 to address PHA concern	Preciado, Silvano E.	11/10/2010	12/1/2010	6	A	Beatham, Keith	Completed
17078	D&R	#4 Crude Unit	2009	74.1.4.1	Concern is that current list of PRDs does not agree with EOMs or handhelds.	Consider revising list of PRDs in EOMs and on handhelds.	This item is complete.	Audited 25% of PRD's and all PRD's audited were captured on the handheld device as well as the eom.	Beatham, Keith	11/1/2010	12/1/2010	7	S	Cartier III, Jacque-Micha	Completed
17079	D&R	#4 Crude Unit	2009	75.2.1.1	Update Crude Unit / DEBRU P&IDs per PHA redlines.	Update Crude Unit / DEBRU P&IDs per PHA redlines.	Drawing updates completed.	Complete per communication from drafting Lead (T.V.)	Preciado, Silvano E.	11/18/2010	12/1/2010			Purvis, Benjamin	Completed
17080	D&R	#4 Crude Unit	2009	75.2.2.1	The following items on the list of in-house alarms appear to have incorrect labels:  42LC093 listed as "T3212 skinned oil level", should be "V3212"  11TI404 listed as "4/5 s/c to tkn cold" should be "4/6"  11FI979 Listed as "8 s/c to E1164" but shown on dead leg on 30833800	Correct the following items on the list of in-house alarms:  42LC093 listed as "T3212 skinned oil level", should be "V3212"  11TI404 listed as "4/5 s/c to tkn cold" should be "4/6"  11FI979 Listed as "8 s/c to E1164" but shown on dead leg on 30833800	Point description for tag 42LC093 has been changed from "T3212 SKIMMED OIL LEVEL" to "V3212 SKIMMED OIL LEVEL"	Both corrections referring to changing T3212 to V3212 and 4/5 cut to 4/6 cut have been made. The 3rd item was verified to be correct the FI is on a dead leg no action is required.	Preciado, Silvano E.	10/29/2010	12/1/2010			Griffin, Charles T.	Completed

## All Recommendations

Thursday, August 09, 2012 10:05:10 AM

Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17081	D&R	#4 Crude Unit	2009	75.6.1.1	Concern is that some items in control house not currently anchored (filing cabinets, vending machines)	Review control house furnishings to ensure proper anchoring in the event of blast or seismic event.	W/R Written and work completed to anchor down cabinets and control house furnishings completed week of 11/1/2010	completed by GMG mechanics	Preciado, Silvano E.	11/17/2010	12/1/2010			Beatham, Keith	Completed
					Review control house furnishings to ensure proper anchoring in the event of blast or seismic event.										
17082	D&R	#4 Crude Unit	2009	75.11.1.	Concern is that a valve may be left 1 in improper position while placing equipment back in service, leading to loss of containment and personnel injury	Consider improving LOTO documentation and procedures, to include "Return To" position for valves/switches when placing equipment back in service.	The current LOTO system insures the system is restored to normal condition a secondary check is completed during the plant yellow lining process. The LOTO tags will have NO - normally open or NC Normally closed written on the at the time of LOTO	Yellow lined P&ID's are adequate to locate any abnormal lineup while putting systems in service	Beatham, Keith	11/9/2010	12/1/2010	6	S	Curry, David P.	Completed
					Consider improving LOTO documentation and procedures, to include "Return To" position for valves/switches when placing equipment back in service.										
17083	D&R	#4 Crude Unit	2009	75.11.3.	Concern is that the vibration shutdowns currently used on fin fans (same on all) may be unreliable and may not shut down fans on high vibration.	Declined. Not considered as a safety concern. Vibration shutdown switches on fin fans currently on work list in an effort to improve reliability.	Declined. Not considered as a safety concern. Vibration shutdown switches on fin fans currently on work list in an effort to improve reliability.			12/1/2010	8	A		Curry, David P.	Declined
					Consider upgrade of current fin fan vibration shutdowns to a more reliable type to minimize equipment damage.										
17084	D&R	#4 Crude Unit	2009	75.13.1.	Concern is that personnel on C-1100 or C-1160 have only one means of egress during an emergency (e.g., fire).	Declined, secondary egress from C-1100 or C-1160 can be built as necessary based on work being performed.	Declined, secondary egress from C-1100 or C-1160 can be built as necessary based on work being performed.			12/1/2010	6	S		Curry, David P.	Declined
					Consider providing alternate means of safe egress from C-1100 or C-1160 during an emergency.										

## All Recommendations

Thursday, August 09, 2012 10:05:10 AM

Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
17085	D&R	#4 Crude Unit	2009	75.17.1.	Consider reviewing items listed 1 from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PSI to reflect changes made.	<p>Reviewing items listed from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PSI to reflect changes made. Specific items as follows:</p> <p>D-308300: BA to A spec break between the P-1101A/B/C discharge piping and the wash oil header is inadequate. Action: Either roll out spools as designed or install blinds immediately downstream of the BA isolation valve.</p> <p>D-308305: TF1 to ABO and BA to ABO spec breaks from E-1116A-F inlet/outlet to the pump out and wash oil headers are inadequate (typ 8) Action: Either roll out spools as designed or install blinds immediately downstream of the first block valve on the process piping (TF1 or BA). Recommend: We should consider upgrading these in the same manner as the PO/WO spools on the hot oil pumps in the plant were upgraded on the 2007 TA (double block and bleed of the higher pipe class).</p> <p>D-308309: BA to A spec break between the P-1128/A suction and the pump out header is not adequate. Action: Either roll out spools as designed or install blinds immediately downstream of the BA isolation valve.</p> <p>D-310483: TF1 to AF1/ABO spec breaks between the K-1181A/B Filters and the pump out and wash oil headers are inadequate. Action: Either roll out spools as designed, or install blinds immediately downstream of the</p>	<p>Maintenance work order written to install blinds and drop temp spools per dwg's, work completed 11/8/10</p>	<p>Blinds have been installed per Design engineering reco's</p>	Beatham, Keith	11/9/2010	12/1/2010			Preciado, Silvano E.	Completed

## All Recommendations

Thursday, August 09, 2012 10:05:10 AM

Record #	ABU	Unit	I/R	Item Nbr	Additional Consideration (Recommendation)	ABU Proposal	Resolution	Verifier Comments	Verifier Name	Verified On	Due Date	RR	SOE	Assigned To	Status
						TF1 isolation valve. Recommend: We should consider upgrading these in the same manner as the PO/WO spools on the hot oil pumps in the plant were upgraded (double block and bleed of the higher pipe class).									

Totals: 29 Records



## LC, Seismic & ISS Findings

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### Latent Condition Finding

ABU D&R Plant #4 CRUDE UNIT

Review Date 9/1/2009 12:49:00 PM Owner Preciado, Silvano E.

Due By 12/1/2010 Status In Progress

#### LC Number & Question

(4-58) Does the location of emergency personal protective equipment (e.g., fire gear, SCBA, acid suits, etc.) allow for rapid access and use?

#### Concern

Emergency PPE is conveniently located. However, there is a concern that there is an insufficient number of SCBA to protect control room personnel.

#### Recommendation

Consider evaluating number of SCBA units in control room to protect all control room personnel in D&R control room.

#### Action Taken

### Latent Condition Finding

ABU D&R Plant #4 CRUDE UNIT

Review Date 9/1/2009 9:07:12 AM Owner Preciado, Silvano E.

Due By 12/1/2010 Status In Progress

#### LC Number & Question

(3-13) Are all equipment labels (e.g., vessels, piping, valves, instrumentation, etc.) easy to read (clear and in good condition)?

#### Concern

Not all equipment labels are perfectly clear (oily, dirty, broken, absent). In particular, lines at the plot limit are inadequately identified.

**Recommendation**

Consider review of labels in #4 Crude Unit, especially lines at the plot limit. Review should include compliance with RI-302 (Color Identification and Labeling of Equipment and Pipelines).

**Action Taken**

Latent Condition Finding			
ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	9/1/2009 8:51:05 AM	Owner	Preciado, Silvano E.
Due By	12/1/2010	Status	In Progress
LC Number & Question			

(3-2) Are remote switches for different systems separated by sufficient distance to prevent operation of the wrong system during stressful situations?

**Concern**

The wrong furnace has been chopped in the past as two switches are close together. It is possible that a cover over the switch might prevent this.

**Recommendation**

Consider providing covers over CM/C shutdown switches on #4 Crude Unit control board to prevent operation of incorrect switch during emergency situations.

**Action Taken**

Latent Condition Finding			
ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	9/1/2009 7:55:32 AM	Owner	Curry, David P.
Due By	12/1/2010	Status	Completed
LC Number & Question			

(2-11) Are procedures difficult to use?

**Concern**

Consistency in the quality of procedures is a concern. This is especially an issue with startup and shutdown procedures. The need for improvement is recognized, and efforts to correct this are ongoing.

**Recommendation**

Consider evaluation of current #4 Crude Unit procedures for accuracy and consistency, particularly startup and shutdown.

**Action Taken**

Declined: Latent Condition Items 592 and 593 will be resolved and tracked by the implementation of Transition Management (on-going GM improvement process). Release 3 will apply to start up and shutdown for #4 Crude.

**Latent Condition Finding**

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	9/1/2009 7:42:08 AM	Owner	Curry, David P.
Due By	12/1/2010	Status	Completed

**LC Number & Question**

(1-5) Do operators have sufficient knowledge to safely operate or shutdown the unit in emergency situations where they must assume manual control?

**Concern**

Senior operators have sufficient knowledge to safely operate or shutdown the unit in emergency situations where they must assume manual control. Concern is that it is primarily senior operators shutdown the unit. Thus, other operators do not have the opportunity to acquire shutdown experience, and control simulation is inadequate for training.

**Recommendation**

Consider improving Crude Unit simulator for shutdown/emergency training, and ensure that operators are given ample simulator training time.

**Action Taken**

Declined: Latent Condition Items 592 and 593 will be resolved and tracked by the implementation of Transition Management (on-going GM improvement process). Release 3 will apply to start up and shutdown for #4 Crude.

**Latent Condition Finding**

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	4/24/2006 9:42:19 AM	Owner	Tydingco, James D.
Due By	9/1/2006	Status	Completed

**LC Number & Question**

(4-3) Is the communication capability between operators, and between operators and the control room or other necessary locations adequate during normal operations and emergencies?

**Concern**

During emergency situations the radio system can be overloaded and operation becomes intermittent. Phones, e-mail and the computer system are normally OK.

**Recommendation**



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Inherently Safer Systems Finding

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/31/2009	Owner	Preciado, Silvano E.
Due By	12/1/2010	Status	In Progress

ISS Number & Question

(A-18) Limit manual operations - like sampling, hose handling, filter cleaning?

### Concern

Common is about the current social and economic sampling methods may result in personnel exposure to hot material containing benzene.

Recommendation

Consider evaluating current resid and desalter sampling procedures and replacing with safer alternatives. Reference MOC 19620; improvement of desalter triline sampling, in progress.

Action Taken

## Inherently Safer Systems Finding

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/31/2009	Owner	Curry, David P.
Due By	12/1/2010	Status	Completed

104

Concern  
T-1400 A-----in Tank. V-1400A Dosemeter Chemical Infection Drum T-1104 Cancer Injection Tank have no spill containment

**Recommendation**

Consider spill containment for T-1108 Ammonia Tank, V-1106A Demulsifier Chemical Injection Drum, T-1104 Caustic Injection Tank.

**Action Taken**

Declined: There is also only a limited quantity of material that could be released in each of scenarios. In the event of a spill, the material would be contained to a paved area with process drains. No further follow-up necessary.

**Inherently Safer Systems Finding**

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/31/2009	Owner	Preciado, Silvano E.
Due By	12/1/2010	Status	In Progress
<b>ISS Number &amp; Question</b>			
(4A2) Simplified control displays?			
<b>Concern</b>			
Concern is that some control displays are cluttered, and finding a necessary screen may be time-consuming, especially during an upset.			
<b>Recommendation</b>			
Consider evaluating individual DCS screens, and organization of screens to improve control navigation within the #4 Crude Unit. Examples include, but are not limited to: Process Overview, Flash Drum V-1102, Long Loop, Short Loop, Vacuum Column			
<b>Action Taken</b>			

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Technical Contact: Sanjeev Pollepalli

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### Seismic Review Finding

ABU D&R

Review Date 8/28/2009

Due By 12/1/2010

Area

F-1100B, F-1160

Concern

Cracked and spalled concrete at anchor bolts. 8/27-pics 6 through 11

Recommendation

Repair concrete.

Action Taken

Plant #4 CRUDE UNIT

Owner Lee, Gerald W.

Status In Progress

### Seismic Review Finding

ABU D&R

Review Date 8/28/2009

Due By 12/1/2010

Area

V-1190

Concern

North end ladder missing anchor bolt. 8/19-pic 1

Plant #4 CRUDE UNIT

Owner Lee, Gerald W.

Status In Progress

**Recommendation**

Install equal size anchor bolt 1.5" left. Use Simpson Strong Bolt or Hilti Kwik Bolt TZ embed 3".

**Action Taken****Seismic Review Finding**

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/28/2009	Owner	Lee, Gerald W.
Due By	12/1/2010	Status	In Progress
Area			
E-1107 A/B			

**Concern**

Anchor bolt nuts too high. 8/19-pic 6

**Recommendation**

Run nuts down

**Action Taken****Seismic Review Finding**

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/28/2009	Owner	Lee, Gerald W.
Due By	12/1/2010	Status	In Progress
Area			
E-1107 A/B			

**Concern**

Spalled concrete north end pedestal. 8/19-pic 7

**Recommendation**

Repair concrete.

**Action Taken**

Seismic Review Finding					
ABU	D&R	Plant	#4 CRUDE UNIT	Owner	Lee, Gerald W.
Review Date	8/28/2009				
Due By	12/1/2010			Status	In Progress
Area	E-1106				
Concern	Cracked pedestal and missing grout. 8/19-pic 8				
Recommendation	Expose rebar at crack and check for corrosion. Notify engineer if corroded rebar diameter is less than 90% of original. Repair concrete and grout.				
Action Taken					

Seismic Review Finding					
ABU	D&R	Plant	#4 CRUDE UNIT	Owner	Lee, Gerald W.
Review Date	8/28/2009				
Due By	12/1/2010			Status	In Progress
Area	E-1103				
Concern	North end anchor bolts too high. 8/19-pic 9				
Recommendation	Run nuts down.				
Action Taken					

Seismic Review Finding					

## HES Findings

Chevron Products Company

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/28/2009	Owner	Lee, Gerald W.
Due By	12/1/2010	Status	In Progress
Area			
V-1103			
<b>Concern</b>	Cracks in fireproofing at junction with insulation - possible corrosion. 8/19-pic 10		
<b>Recommendation</b>	Remove fireproofing in small spots, check for corrosion and repair fireproofing.		
<b>Action Taken</b>			

<b>Seismic Review Finding</b>			
ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/28/2009	Owner	Lee, Gerald W.
Due By	12/1/2010	Status	In Progress
Area			
Fin Fans			
<b>Concern</b>	Tension brace cut and used as pipe support. 8/19-pic 11		
<b>Recommendation</b>	Provide bracing. Consider reroute of pipe.		
<b>Action Taken</b>			

<b>Seismic Review Finding</b>			
ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/28/2009	Owner	Lee, Gerald W.
Due By	12/1/2010	Status	In Progress
Area			

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Area	Fin Fans
Concern	Badly cracked fireproofing at base of many fin fan columns. 8/19-pics 12 through 15
Recommendation	Replace fireproofing using reinforcing wire mesh to keep it intact.
Action Taken	

Seismic Review Finding	
ABU	D&R
Review Date	8/28/2009
Due By	12/1/2010
Area	V-1100 Deck Structure
Concern	Fireproofing missing at junction of two beams at NW corner. 8/19-pic 16
Recommendation	Remove some of the fireproofing, check for corrosion of the structural steel and replace fireproofing.
Action Taken	

Seismic Review Finding	
ABU	D&R
Review Date	8/28/2009
Due By	12/1/2010
Area	Structural Columns near V-1104

<b>Concern</b>
Cracked and spalling fireproofing. 8/27-pics 1 through 3
<b>Recommendation</b>
Remove some fireproofing to check for corrosion, replace same and repair cracks.

<b>Seismic Review Finding</b>					
ABU	D&R	Plant	#4 CRUDE UNIT	Owner	Lee, Gerald W.
Review Date	8/28/2009				
Due By	12/1/2010				
Area	V-1190				
<b>Concern</b>					
Spalled concrete & corroded rebar on pedestal column. 8/19-pic 1 ,					
<b>Recommendation</b>					
Remove loose concrete near rebar and repair concrete. Notify engineer if corroded rebar diameter is less than 90% of original.					
<b>Action Taken</b>					

<b>Seismic Review Finding</b>					
ABU	D&R	Plant	#4 CRUDE UNIT	Owner	Lee, Gerald W.
Review Date	8/28/2009				
Due By	12/1/2010				
Area	C-1140				
<b>Concern</b>					
Spalled fireproofing at base. 8/19-pic 5					
<b>Recommendation</b>					

Remove some fireproofing to check for corrosion and replace same.

Action Taken

Seismic Review Finding					
ABU	D&R	Plant	#4 CRUDE UNIT	Owner	Lee, Gerald W.
Review Date	8/28/2009	Status	In Progress		
Due By	12/1/2010	Area	V-1198	Concern	Inadequate nut to anchor bolt engagement both ends. 8/27 - pics 22 & 23
Recommendation		Replace existing nuts with Elocone nuts or equivalent.	Action Taken		

Seismic Review Finding					
ABU	D&R	Plant	#4 CRUDE UNIT	Owner	Lee, Gerald W.
Review Date	8/28/2009	Status	In Progress		
Due By	12/1/2010	Area	V-1160 A/B	Concern	Missing bolts. 8/27-pic 12
Recommendation		Install bolts	Action Taken		

Seismic Review Finding			
ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/28/2009	Owner	Lee, Gerald W.
Due By	12/1/2010	Status	In Progress
Area	C-1160 Transfer Line		
Concern	Vibrating brace. 8/27-pic 13		
Recommendation	Inspect brace. Adjust or replace as required.		
Action Taken			

Seismic Review Finding			
ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/28/2009	Owner	Lee, Gerald W.
Due By	12/1/2010	Status	In Progress
Area	E-1188		
Concern	South end anchor bolt nuts too high. 8/27-pic 14		
Recommendation	Run nuts down		
Action Taken			

Seismic Review Finding			
ABU	D&R	Plant	#4 CRUDE UNIT

**HES Findings**

Chevron Products Company

<b>Review Date</b>	8/28/2009	<b>Owner</b>	Lee, Gerald W.
<b>Due By</b>	12/1/2010	<b>Status</b>	In Progress
<b>Area</b>			
E-1165B			
<b>Concern</b>	South end anchor bolts missing. 8/27-pic 15		
<b>Recommendation</b>	Install bolts		
<b>Action Taken</b>			

**Seismic Review Finding**

<b>ABU</b>	D&R	<b>Plant</b>	#4 CRUDE UNIT
<b>Review Date</b>	8/28/2009	<b>Owner</b>	Lee, Gerald W.
<b>Due By</b>	12/1/2010	<b>Status</b>	In Progress
<b>Area</b>			
E-1110B			
<b>Concern</b>	North end anchor bolts loose. 8/27-pic 16		
<b>Recommendation</b>	Tighten anchor bolts		
<b>Action Taken</b>			

**Seismic Review Finding**

<b>ABU</b>	D&R	<b>Plant</b>	#4 CRUDE UNIT
<b>Review Date</b>	8/28/2009	<b>Owner</b>	Lee, Gerald W.
<b>Due By</b>	12/1/2010	<b>Status</b>	In Progress
<b>Area</b>			

Concern	E-1109
South end anchor bolts too high. 8/27-pic 17	
Recommendation	
Run nuts down	

Seismic Review Finding	
ABU	D&R
Review Date	8/28/2009
Due By	12/1/2010
Area	E-1108C
Concern	North end anchor bolts too high. 8/27- pic 18
Recommendation	Run nuts down
Action Taken	

Seismic Review Finding	
ABU	D&R
Review Date	8/28/2009
Due By	12/1/2010
Area	E-1113
Concern	

South end anchor bolt nuts too high. 8/27- pic 19

**Recommendation**

Run nuts down

**Action Taken****Seismic Review Finding**

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/28/2009	Owner	Lee, Gerald W.
Due By	12/1/2010	Status	In Progress
Area			
Concern			

South end anchor bolt nuts too high. 8/27- pic 20

**Recommendation**

Run nuts down

**Action Taken****Seismic Review Finding**

ABU	D&R	Plant	#4 CRUDE UNIT
Review Date	8/28/2009	Owner	Lee, Gerald W.
Due By	12/1/2010	Status	In Progress
Area			
Concern			

South end anchor bolts loose. 8/27- pic21

**Recommendation**

Tighten bolts

Action Taken

Seismic Review Finding	
ABU	D&R
Review Date	8/28/2009
Due By	12/1/2010
Area	C-1104
Concern	Spalled fireproofing at base. 8/19/plc 4
Recommendation	Remove some fireproofing to check for corrosion and replace same.
Action Taken	

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# MOC Status

9/2/2009 1:01:00 PM

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
20769	D&R	4 Crude	Petzak, Bradlee M.	8/28/2009	Sorley, Andrew P.					
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: DWG Update MOC V-1102								
		Description of Change: update online DWG								

20683	D&R	4 Crude	Preciado, Silvano E.	8/10/2009	Preciado, Silvano E.					
		Type: Temporary	Category: Routine		Expiration Date:	8/30/2009				
		Project/Equipment Title: Change the bushings on V-1102								
		Description of Change: Following 4CU pit stop the desalter grids have not established volt reading. The desalter will be bypassed to change the bushings on the run.								

20682	D&R	4 Crude	Braxton, Charles R.	8/10/2009	Preciado, Silvano E.					
		Type: Permanent	Category: Project		Expiration Date:					
		Project/Equipment Title: Exapiot Release 3: Integration of advanced programming tools into 4 Crude Unit Start-up/Shutdown Procedures								
		Description of Change: Shutdown Tools: incorporate tasks into an Advanced Programming Yokogawa procedure ExaPilot platform. Procedures will leverage off of current D&R 4 Crude Unit Start-up/Shutdown Procedure already in place. Intent is to standardize application of procedure utilization, reduce execution time up to 25%, reduce associated risk of execution, incorporate electronic signature confirmations, provide electronic storage of completed signatures and reduce paper usage.								

20681	D&R	4 Crude	Braxton, Charles R.	8/10/2009	Preciado, Silvano E.					
		Type: Permanent	Category: Project		Expiration Date:					
		Project/Equipment Title: Exapiot Release 2: Incorporate Advanced Programming Tools into Existing Emergency Procedures								
		Description of Change: Purpose of this MOC is to utilize Emergency and Safe Park Tools: incorporate tasks into an Advanced Programming Yokogawa procedure ExaPilot platform. Procedures will leverage off of current D&R 4 Crude Unit Shutdown Procedure already in place. Intent is to standardize application of procedure utilization, reduce execution time up to 25%, reduce associated risk of execution, incorporate electronic signature confirmations, provide electronic storage of completed signatures and reduce paper usage.								

20678	D&R	4 Crude	Braxton, Charles R.	8/10/2009	Preciado, Silvano E.					
		Type: Permanent	Category: Project		Expiration Date:					
		Project/Equipment Title: Exapiot Release 1: Integration of programming tools supporting daily activities								
		Description of Change: Purpose of this MOC is to utilize Routine Procedures and incorporate tasks into an Advanced Programming Yokogawa procedure ExaPilot platform utilizing user defined tools. Tools will be designed to compliment existing D&R Operating Procedures support Operator Task execution. Intent is to standardize application of procedure utilization, reduce execution time up to 25%, reduce associated risk of execution, incorporate electronic signature confirmations, provide electronic storage of completed signatures and reduce paper usage.								

# MOC Status

9/2/2009 1:01:00 PM

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
20653	D&R	4 Crude	Preciado, Silvano E.	8/3/2009	Preciado, Silvano E.		1	2		
		Type: Temporary	Category: S/D	Expiration Date:						
		Project/Equipment Title: <u>E-1109 tune side low point bleeder valve leaks by.</u>								
		Description of Change: A second valve (and nipple) will be installed to allow safe connections for exchanger clean up.								
20635	D&R	4 Crude	Poland, Matthew D.	7/30/2009	Preciado, Silvano E.	4104	1	2		
		Type: Permanent	Category: S/D	Expiration Date:						
		Project/Equipment Title: <u>4CU / 3Q2009 PITSTOP / E-1103 - Seal Weld Channel Plugs</u>								
		Description of Change: Drain valve on old channel was blocked by piping and not usable.								
20620	D&R	4 Crude	Curry, David P.	7/29/2009	Curry, David P.		1	2		
		Type: Permanent	Category: Routine	Expiration Date:						
		Project/Equipment Title: <u>PSM Drawing Update</u>								
		Description of Change: Two drawings D-3333702 and D-319944 need to have Tank number changed from T-3144 to T-3126 In 2000 T-3126 was put I/S replacing T-3144 the ABU Dwg's were changed some of the refinery Dwg's were not.  <i>D-325559</i>								
20618	D&R	4 Crude	Greenfield, John M.	7/29/2009	Preciado, Silvano E.	4094	1	2		
		Type: Permanent	Category: S/D	Expiration Date:						
		Project/Equipment Title: <u>D&amp;R / 4Crude / 150# Sum to 50# Stmt Letdown Piping Repair</u>								
		Description of Change: Valve will be installed just off of the 50# steam header to add in isolation for future work.								
20599	D&R	4 Crude	Schultz, Gordon L.	7/23/2009	Preciado, Silvano E.		1	2		
		Type: Temporary	Category: Leak Seal	Expiration Date:						
		Project/Equipment Title: <u>V-1164 LP condensate return to PLM between P/S 10 &amp; 11 I-80 side near P-1101C</u>								
		Description of Change: 4" LP condensate line CUI leak @ about 3 or 9 O'Clock from which ever way you look at it will see a temporary skinner clamp until permanent repairs can be scheduled								

# MOC Status

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
20467	D&R	4 Crude	Curry, David P.	6/17/2009	Curry, David P.				1	

**Project/Equipment Title:** Remove Temperature alarm limit, resid overflash

**Description of Change:** I talked to Randy today about the overflash high temperature alarm. The general outcome of the conversation was that it is okay to exceed the limit. Coking does increase exponentially as temperature increases. It actually doubles with every 10 F increase in temperature. However, the worst thing that will happen is we'll build up coke in the tray sump and P1178 suction line and have to clean it out during the next turnaround. It shouldn't hinder the process or bring the unit down.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
20460	D&R	4 Crude	Cooke, Lauren A.	6/17/2009	Preciado, Silvano E.				1	

**Project/Equipment Title:** Update Drawing 0955-036-B03

**Description of Change:** The drawing references the wrong drawing when referring from Pump Vents to C-1160, so the drawing needs to be updated to reference the correct drawing.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
20427	D&R	4 Crude	Lenahan, Laura A.	6/9/2009	Preciado, Silvano E.				1	

**Project/Equipment Title:** Pull 2 S/C from the ATCR Permanently

**Description of Change:** We used to pull 2 S/C from the column, through the side-cut stripper, the 2 S/C pump (P1129) and through E1103/4 (2 SC / crude exchangers). The 2 S/C draw rate was hydraulically limited to ~28 MBD.

When E1103/4 developed a leak we began pulling 2 S/C from the ATCR in order to bypass E1103/4 (ATCR is pulled from the same tray as 2 S/C). The 2 S/C flow is currently routed through an ATCR to 2 S/C jump over line. The line ties into the 2 S/C line just upstream of the 2 S/C flow control valve (11FC021) and downstream of E1103/4. Since the ATCR pump (P1128) puts up more head than P1129, we were able to increase the 2 S/C draw rate by 6+ MBD.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
20425	D&R	4 Crude	Cooke, Lauren A.	6/8/2009	Preciado, Silvano E.	4008			1	

**Project/Equipment Title:** 3Q 2009 4CU Pitstop - 50# Steam- Cut Off and Cap

**Description of Change:** Cutting pipe and adding cap to cut off steam flow to leaking, out-of-service pipe.

# MOC Status

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MOC Number ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
20323 D&R	4 Crude Type: Temporary Project/Equipment Title: 3Q_2009_4CU_Pitstop_Temporary_Piping	Hulse, Benjamin Category: S/D Description of Change: Adding temp piping for plant clean up.	5/14/2009 Expiration Date: 8/30/2009	Preciado, Silvano E.	3824	1	2	3	
20315 D&R	4 Crude Type: Permanent Project/Equipment Title: TP_1165A_turbine_case drain stem trap style does not have a check (ball/ flapper) to prevent back flow of hot condensate	Schultz, Gordon L. Category: Routine Description of Change: A inline flapper style check valve (TLV, CO., MDL:CKF3M, operates up to 420psig @622°F ) it will be installed in the down stream flange of the trap and on the exhaust-LP side of the turbine case to prevent hot condensate from blowing out backwards and spraying personnel while operating the (TP-1165A) pump	5/13/2009 Expiration Date: 8/7/2009	Preciado, Silvano E.	1				
20304 D&R	4 Crude Type: Temporary Project/Equipment Title: Eliminate 4CU_PCO after 4_CU has been S/D during the Pitstop	King, Lowell J. Category: S/D Description of Change: Plant will be S/D, and there will not be a need for the PCO.	5/12/2009 Expiration Date: 8/7/2009	Preciado, Silvano E.	1	2	3		
20264 D&R	4 Crude Type: Permanent Project/Equipment Title: Turn power off to disable the furnace CO analyzers that have failed or have unreliable outputs.	Preciado, Silvano E. Category: Routine Description of Change: Due to aging combustion CO analyzers we no longer have the ability repair or maintain these instruments because replacement parts are not available. The recommendation from Analyzer Specialist and our corporate Furnace Process Master is to shutdown the power to the points that are sending faulty reading (COMB analyzer) and realign the CO reading to receive the data from the CEMS analyzer. The current furnaces that are affected are F100A, F1100B and F1160.	5/5/2009 Expiration Date:	Preciado, Silvano E.	1	2			
20260 D&R	4 Crude Type: Permanent Project/Equipment Title: D&R / 4Crude / Spare_E_1165_Tie-Ins	Greenfield, John M. Category: Routine Description of Change: These tie-ins will be a permanent modification for possible future use to install bypasses or parallel HX's around the E1165's as needed. This MOC covers the Resid tie in only.	5/4/2009 Expiration Date:	Preciado, Silvano E.	3775	1	2		

# MOC Status

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Canceled
20225	D&R	4 Crude	Preciado, Silvano E.	4/27/2009	Preciado, Silvano E.		1	2		

**Project/Equipment Title:** Leak on blowdown line from V1615 at 4CU outside plot limit. About 15'-20' from where line wedges up to 3" size line

**Description of Change:** New leak on top side (12 o'clock position) of line. Will require special order 24" inch clamp.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Canceled
20214	D&R	4 Crude	Poland, Matthew D.	4/23/2009	Preciado, Silvano E.		3900	1	2	

**Project/Equipment Title:** 3Q\_2009 4CU Pitstop - Bleeder Blinds for Resid Tie-ins near E-1110's

**Description of Change:** Bleeder Blinds will allow operations to verify that block valves are holding prior to removing blinds to connect future piping on-the-run.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Canceled
20207	D&R	4 Crude	Curry, David P.	4/22/2009	Curry, David P.		3860	1	2	

**Project/Equipment Title:** V-1100 sample draw add two valves

**Description of Change:** The main block on V-1100 sample draw leaks by , we will add two new valves down stream of the existing valves to give us a double block. This will be replaced during the S/D

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Canceled
20141	D&R	4 Crude	Poland, Matthew D.	4/8/2009	Preciado, Silvano E.		3860	1	2	

**Project/Equipment Title:** 2009 Pitstop Install ATCR - 2 S/C Piping Tie-in

**Description of Change:** Currently we are bypassing E-1103 & E-1104 on the tube side and instead sending 2 S/C through the ATCR line to FV-021 and on to JHT. If we were to put E-1103 & E-1104 back into service, this tie-in would allow us to add a spool on the run that would let us send additional 2 S/C to JHT via P-1128 and the ATCR line.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Canceled
20082	D&R	4 Crude	Poland, Matthew D.	4/1/2009	Preciado, Silvano E.		3794	1	2	

**Project/Equipment Title:** 3Q\_2009 4CU PITSTOP - GENERAL VALVE LIST

**Description of Change:** Replacing unused spool with bleedder blind, replacing globe valve with gate valve; Updating P&ID's

# MOC Status

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
20081	D&R	4 Crude	Greenfield, John M.	4/1/2009	Preciado, Silvano E.	3831	1	2		

Project/Equipment Title: 4CU - P-1167 Modify Seal/Elastomer

Description of Change: Piping to be replaced and re-routed due to internal corrosion as per maintenance specifications.

20053	D&R	4 Crude	Preciado, Silvano E.	3/26/2009	Preciado, Silvano E.		1	2		
		Type: Permanent	Category: Routine	Expiration Date:						

Project/Equipment Title: Install clamp or wrap on fire water hydrant.

Description of Change: Hydrant leaking fire water from 2in ch nipple. The location is by E1165.

20034	D&R	4 Crude	Preciado, Silvano E.	3/24/2009	Preciado, Silvano E.		1	2		
		Type: Temporary	Category: Leak Seal	Expiration Date:	5/1/2012					

Project/Equipment Title: Install leak seal on bleeder valve to stop/prevent leak on 7 s/c seal flush line to P1167.

Description of Change: This is a non threaded high point bleeder that should have had a seal welded plug installed when the line was originally hydrotested. A leak seal clamp is needed to stop leakage from the valve until repair can be made at the next major shutdown.

20015	D&R	4 Crude	Preciado, Silvano E.	3/18/2009	Preciado, Silvano E.		1	2		
		Type: Permanent	Category: Routine	Expiration Date:						

Project/Equipment Title: Change furnace damper control on F1160 to cost variable.

Description of Change: To improve furnace efficiency by driving down O2.

20014	D&R	4 Crude	Preciado, Silvano E.	3/18/2009	Preciado, Silvano E.		1	2		
		Type: Permanent	Category: Routine	Expiration Date:						

Project/Equipment Title: Change damper control on F1100A and F1100B to cost variable.

Description of Change: To improve efficiency of furnace operation by pushing down O2.

# MOC Status

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
20012	D&R	4 Crude	Curry, David P.	3/18/2009	Curry, David P.					
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: Add a Temperature alarm for F_1100B_Bridge_Wall								
		Description of Change: Environmental regulations call for us to have a monitoring system to insure we don't operate under our minimum Bridge wall temperature on F-1100B - We have TI but can't demonstrate we have a activation system to inform operations when if falls below 1050 ( need to confirm maybe 1100 degrees)								
19969	D&R	4 Crude	Lenahan, Laura A.	3/11/2009	Preciado, Silvano E.					
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: Re-range 11F1506 (ATCR to E1108) transmitter								
		Description of Change: This MOC is to re-range the transmitter associated with 11F1506 / increase the maximum flow rate from 120 MBD to 150 MBD. The flow rate periodically exceeds the maximum flow rate of 120 MBD and we are unable to monitor the true flow rate. The maximum flow rate should be increased to the maximum total ATCR rate in case all flow was routed through E1108.								
19969	D&R	4 Crude	Greenfield, John M.	1/23/2009	Preciado, Silvano E.	3342	1			
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: D&R / 4Cu / V-1190 / Level Gauge_Bridge Replacement								
		Description of Change: Corrosion of piping leading into sight glass approaching t-min. Adding vents on the sight glass unit to aid in future cleaning and/or draining.								
19620	D&R	4 Crude	Greenfield, John M.	1/9/2009	Preciado, Silvano E.	3544	①			
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: D&R / 4Cu / V-1102_Sample Station Modification			Description of Change: Address in Descaler Node					
		Description of Change: The samples taken from this station are being taken at an unsafe temperature and pressure. By replacing some valves and redesigning piping spools, the samples can be taken at a safer temperature and pressure.								
		Total 33								

**MOC status**  
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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
19240	D&R	4 Crude	Hulse, Benjamin	10/14/2008	Preciado, Silvano E.	33337	1	2	3	
		Type: Temporary	Category: S/D		Expiration Date: 12/31/2008					
		Project/Equipment Title: 4CU - E1107 - Temporary Clean-Up Piping								
		Description of Change: Piping will allow Ops to clean the E-1107's.								
19197	D&R	4 Crude	Curry, David P.	10/2/2008	Curry, David P.	3309	1	2	3	
		Type: Temporary	Category: Project		Expiration Date: 12/12/2008					
		Project/Equipment Title: Isolate the E-1107's exchangers								
		Description of Change: There is a crude to ATCR leak on E-1107 B - this MOC is isolate the E-1107 A&B exchangers . We will need to pipe the crude side bleeder to drain back into the flash column or similar location.								
19065	D&R	4 Crude	Lenahan, Laura A.	9/8/2008	Preciado, Silvano E.	1	1	2	3	
		Type: Temporary	Category: Routine		Expiration Date: 2/1/2009					
		Project/Equipment Title: Coated F1160 Burner Test Run								
		Description of Change: For this test, 16 ceramic coated burner tips will be installed in F1160, along with 16 uncoated burner tips. It is a low emissivity coating that should help reduce coking / burner plugging. After ~ 3 months, the burner tips will be pulled. The flowrate through the coated burner tips and deposits inside will be compared to that of the uncoated burner tips.								
19038	D&R	4 Crude	Curry, David P.	9/2/2008	Curry, David P.	1	1	2	3	
		Type: Temporary	Category: S/D		Expiration Date: 10/8/2009					
		Project/Equipment Title: Reduce Emergency wash oil amount								
		Description of Change: To prepare for the DHT shutdown we will go below our stated minimum 30 MB of wash oil. We will take T-1492/93 to a minimum of 20 MB. In the event we need wash oil in a emergency we will use finished Dst to supplement Dst to supplement our 20 MB wash oil. See 21 day plant note Continue to draw T-1492/93 down 2.5-3M/Bbls / Day 8/27-9/4. Objective is to reach 20M available inventory on by 9/4. The 20M inventory target is down from the SOP target inventory of 30M Bbls. The lowering of the target inventory is being done to maximize available room in intermediate tankage for #35/C containment at the start of the DHT S/D.								
		• Note: D&R management has approved the temporary reduction of available inventory in T-1492/93 from 30M to 20M for the August 28th - September 4th window. If an emergency occurs requiring more than the 20M available Bbls of HS Diesel, move finished diesel to T-1492/93 as required								

# MOC status

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
18774 D&R	4 Crude	Weber, Patrick D.	7/17/2008 Curry, David P.				1	2	3	
Project/Equipment Title:	Install Klene Indicator valves on K-1100B	Type: Permanent	Category: Routine	Expiration Date:						
Description of Change:	Installation of Klene indicator valves allows for performance monitoring of the machine by data collectors such as the Dynalco RecipTrap. The valves install directly on the cylinder and allow the data collector to measure gas pressures inside the compressor cylinder.									
A magnetic pickup will also be installed on the end of the motor shaft to generate a speed signal that is input into the data collector during performance monitoring activities.										
18603 D&R	4 Crude	Post, Ronald W.	6/5/2008 Preciado, Silvano E.			3013	1	2	3	
Project/Equipment Title:	K1100B - Piping - Replace Four Bad Order Valves and Add Flanges to Facilitate Compressor Disassembly	Type: Permanent	Category: Routine	Expiration Date:						
Description of Change:	Facilitate compressor disassembly									
18567 D&R	4 Crude	Lenahan, Laura A.	6/2/2008 Preciado, Silvano E.				1	2	3	
Project/Equipment Title:	Increase 11FT014 Range to 34 MBD	Type: Permanent	Category: Routine	Expiration Date:						
Description of Change:	This MOC is for increasing the 11FT014 range (upper) from 30 MBD to 34 MBD in order to increase the 2 S/C draw rate and increase total distillate production.									
Historically, 2 S/C has been hydraulically limited. The 2 S/C stripper level control valve position runs up against its upper limit. After the E1103 leak, E1103/4 and the 2 S/C stripper were bypassed, removing the hydraulic limit. The 2 S/C flow rate is currently controlled by 11FC021, but the flow is measured using 11FT014 on the ATCR to 2 S/Cumpover line.										
18315 D&R	4 Crude	Christian, Timothy J.	4/1/2008 Preciado, Silvano E.			2871	1	2	3	
Project/Equipment Title:	\-1104 Bleeder replacement	Type: Permanent	Category: Routine	Expiration Date:						
Description of Change:	Replacing 3/4" line with 1-1/2" will make performing a chem clean on the system easier.									

**MOC status**  
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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
18218	D&R	4 Crude	Cawthorn, Lawrence G.	2/29/2008	Curry, David P.		1	2	3	

Type: Emergency/Temporary      Category: Routine      Expiration Date: 5/31/2008

Project/Equipment Title: F1160 Transfer Line Temperature Control

Description of Change: Due to TI060 RTD failure control is being transferred to TI602 until a new one can be ordered.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
18153	D&R	4 Crude	Kabler, Katie	2/20/2008	Curry, David P.		1	2	3	

Type: Permanent      Category: Routine      Expiration Date:

Project/Equipment Title: Change the range on 11F1017

Description of Change: 11F1017 currently measures the crude flowrate of crude feed entering the plot limit of the 4CU. It was found that the current range of this meter (11F1017) in honeywell is 256 in H2O, however the differential pressure range on the orifice sizing data sheet for this orifice is 250.9 in H2O. On 3/13/08 the orifice size on the tab was checked and verified to be 11.57". The differential pressure was calculated in the ChevFlow database and for an orifice size of 11.57" the actual dp that should be used to range the meter in Honeywell is 250.3". We would like to change the range of this meter in honeywell to 250.3 in H2O so that the range is correct and the flow measurement is more accurate. Also, the chevflow database will be updated. We expect an approximate 1% increase in the reading of the flowrate from 11F1017 after the change is made to the range. During the investigation of this discrepancy Tony Vink and I did not find any documentation on why this range would have been changed. Note, this change will help our plant mass balance close.

Total 10

**MOC status**  
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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
17924	D&R	4 Crude	Zayouna, Zaid	12/21/2007	Preciado, Silvano E.	2651	1	2	3	
		Type: Permanent	Category: Project	Expiration Date:						
		Project/Equipment Title: Motor Amps to LSFO Control House for MP-1168/A and MP-1169								
		Description of Change: Installing these current transducers will allow for sending signals to LSFO control house to view current readings on these three pumps. The operators will be able to monitor the motors to prevent overloading the motors.								
17851	D&R	4 Crude	Trail, James A.	12/1/2007	Preciado, Silvano E.		1	2	3	
		Type: Permanent	Category: Routine	Expiration Date:						
		Project/Equipment Title: Change alarm setpoint K-1149/A-11PD401A to 15 psi								
		Description of Change: The K-1149 filters use a 20micron filter. The current alarm setpoint is 10psig. When a new element is installed the starting DP is 8psi DP. The filter housing is rated for a 75psi DP. By raising the alarm setpoint a longer run will be possible between filter changes.								
17576	D&R	4 Crude	Griffin, Charles T.	9/28/2007	Wilson, Clifford P.		1	2	3	
		Type: Permanent	Category: Routine	Expiration Date:						
		Project/Equipment Title: 4 Crude_Honeywell_Local_Control Network system upgrade to R670.1								
		Description of Change: To keep our system current with the latest Honeywell release incorporating latest fixes								

# MOC status

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
17519	D&R	4 Crude	Curry, David P.	9/18/2007	Curry, David P.		1	2	3	
		Type: Temporary	Category: Routine		Expiration Date: 10/24/2009					
		Project/Equipment Title: P-1179 amp limit - change alarm point to 245 amps								
		Description of Change: Change the P-1179 amp limit to 245 amps FLA is 222 amps								
		MP-1179 will be run at a max amp limit of 245 amps. This limit is based on the allowable service factor for the motor. We have a 200 H.P. motor with a 1.15 factor which can operate at 15% overload. We will operate at nearer to 10% overload which will be 245 amps. The max amps will be calculated based on Amps Vs flow rate and if repairable the amp meter. Running at the higher load will decrease the motor life, we will have IMI monitor monthly. We will schedule a motor change out every 4 months to start, based on testing we will alter frequency. We plan to leave MP-1179 in service and return 1.189A back to common spare. The P-1189a seal flush line routing change is currently under way by the projects group and should complete next week								
		The following tests and checks will be done on MP-1179.								
		1. Size and test the overloads on the motor starter for MP-1179 - This will set the thermal overload and time relay <input checked="" type="checkbox"/> D&E Bobby Siebenrock ( complete )								
		2. Repair Amp meter form field to house or set the max amp limit of 245 amps based on flow rate. <input checked="" type="checkbox"/> Operations & Electrical group ( complete )								
		□ The flow test results 16.6 MBD @ 243 amps - Limit 7 S/C draw rate to 16.6 MBD until further notice								
		3. Check motor and wire is good from MP-1179 back to switch gear <input checked="" type="checkbox"/> D&E Bobby Siebenrock ( complete )								
		4. Set up routine IMI monitoring of MP-1179 ( biweekly to start ) <input checked="" type="checkbox"/> IMI Dave House								
		5 Trouble shoot MP-1179 amp meter from field to house <input checked="" type="checkbox"/> Tony Vink								
		6 P-1189a seal flush piping reroute ( in progress ) <input checked="" type="checkbox"/> Paul Reid								
17486	D&R	4 Crude	Curry, David P.	9/12/2007	Curry, David P.		1	2	3	
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: Alter the DCS to allow the CBO to select 8 S/C level control from the D/P cell or the radioactive source control								
		Description of Change: Provide Operations the ability to select the D/P for 8 side out as the controller when the radioactive controller is failed due to X-Ray. Currently the control change needs to be done by controls group.								
17442	D&R	4 Crude	Murphy, Patrick K.	8/27/2007	Zarbis, James T.		2495	1	2	3
		Type: Permanent	Category: Project		Expiration Date:					
		Project/Equipment Title: 4CY - P-1189/A - Relocate P-1189/A Seal Flush Piping								
		Description of Change: In order to allow proper cooling/flow of seal flush to the P-1189/A's mechanical seal, the seal flush pressure must be at least 25 psig greater than the stuffing box pressure. Currently, the stuffing box pressure is between 140-160 psig and the seal flush pressure from 7 SC is 175 psig downstream of the control valve. The current setup does not provide the required change in pressure.								

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
17362 D&R	4 Crude	Kabler, Katie	8/7/2007 Curry, David P.				1	2	3	Cancelled
Project/Equipment Title:	4CU- Add alarms to the honeywell system for notification purposes only	Type: Permanent	Category: Routine	Expiration Date:						
Description of Change:	The jet freeze analyzer signal (11A1020) is passed through a program (Aspen IQ) which filters the signal for indicators that the analyzer signal is no longer dependable. Currently this program will flag the analyzer reading as unreliable if the reading from the analyzer is greater than -25F or lower than -45F. If the reading is outside this range, then the program will send a bad signal to 11A1020C. This MOC will put a low priority on the BAD PV alarm (currently NO ACTION) on 11A1020C, so that the PCO will know when the jet freeze analyzer is reading beyond above range limits so that they can take appropriate action, which would be entering a work order for the jet analyzer when it is not operating correctly.									
Another alarm to be added to the honeywell system is a low ammonia injection flowrate alarm at 11fc502 = 1 gph and 11fc070 = 1 gph. These alarms will be enabled when the plant is operating normally, with the specifics of "normal" determined by the control folks. Response to alarms should be checking the ammonia flow for correct operation and re-establishing flow as necessary.										
Addition to MOC on 11/29: Decrease alarm limit for low steam pressure in V-1197, 11P1945, (steam pressure for C-1190 reboilers, E-1197). This alarm limit was increased before the shutdown when the reboiler was found to be leaking, so the justification for the change prior to the replacement of the E-1197 during the shut down was to keep the steam pressure higher than the column pressure to ensure hydrocarbon did not leak into the steam system. Today, the new E-1197's are not leaking and we are consistently operating the V-1197 below the column pressure in the low pressure alarm state. This change will make the alarm inactive under normal operation, and the low pressure alarm setpoint will be set low enough to activate in a "loss in line pressure" scenario, thus the current setpoint of 90 psig will be decreased to 40 psig.										
17206 D&R	4 Crude	Capshaw, Michelle L.	7/3/2007 Capshaw, Michelle L.				1	2	3	
Project/Equipment Title:	Drill E-1100A BFW PSV C7-22 (PSV064) cap to allow future gag to be used if safety lifts	Type: Permanent	Category: Routine	Expiration Date:						
Description of Change:	The PSV is currently lifted and will not reset. In order to reset the safety, the cap must be unscrewed to perform maintenance. To facilitate work on this safety in the future, a hole will be drilled in the cap to allow the safety to be gagged to reset in the future. This work will not affect the performance of the safety once it is reset.									
17029 D&R	4 Crude	Onick, Fred G.	5/14/2007 Trall, James A.				2356	1	2	3
Project/Equipment Title:	P-1105/A Install pump warm up lines	Type: Permanent	Category: Routine	Expiration Date:						
Description of Change:	A warm up line will allow a more accurate pump alignment by maintaining pump case temperature closer to actual operating conditions. Identified that thermal growth is moving pump causing failure of the coupling.									

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
17001 D&R	4 Crude	Mulakken, Nikhil J.	5/2/2007 Curry, David P.			2225	1	2	3	
Project/Equipment Title:	Install three flow transmitters for the No. 7 S/C Flush Oil System	Category: Project	Expiration Date:							
Description of Change:	The no. 7 sidecut off the crude unit can either go to RLOP or go to the flush oil system for existing pumps. When it is not going to RLOP Chevron obtains no value for the product. As a result the flowmeters are to be installed for material balance purposes to see where the no. 7 side cut is going.									
16932 D&R	4 Crude	Curry, David P.	4/6/2007 Curry, David P.			2447	1	2	3	
Type: Permanent	Temporary	Category: Leak Seal	Expiration Date: 1/2/2012							
Project/Equipment Title:	Y-1160 clamp design is also being considered									
Description of Change:	install a clamp Install a metal clamp which will last until next plant shutdown. The skinner clamp will be short term and replaced by cutting the line, and adding a flange, which will be boltermaked off.									
16921 D&R	4 Crude	Trall, James A.	4/3/2007 Preciado, Silvano E.			1	2	3		
Type: Permanent	Routine	Category: Routine	Expiration Date:							
Project/Equipment Title:	Overflash quench tray high temperature alarm.									
Description of Change:	Add low priority high temperature alarm to 11TT078 Overflash quench tray temp.									
16910 D&R	4 Crude	Post, Ronald W.	4/1/2007 Wilson, Clifford P.			2251	1	2	3	
Type: Emergency/Pe	rrmanent	Category: S/D	Expiration Date:							
Project/Equipment Title:	HOT TAP - ABCR Piping Seal Weld									
Description of Change:	seal weld nipple (both ends) and bulk plug on high point vent piping at ABCR to E-1111.									
16852 D&R	4 Crude	Mulakken, Nikhil J.	3/13/2007 Curry, David P.			2226	1	2	3	
Type: Permanent		Category: S/D	Expiration Date:							
Project/Equipment Title:	Power and control for CEMS F-1160_F-1100A sample heat trace									
Description of Change:	In the process of reconstructing after the #4 crude fire a heat trace wire was ordered that was different from the original rating. To avoid a one week lead time along with extensive work to pull the new heat trace it was decided to provide more power and modify the control scheme for the new heat trace wire.									

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
16851	D&R	4 Crude	Zarbis, James T.	3/13/2007	Preciado, Silvano E.		1	2	3	

**Project/Equipment Title:** CURE - Misc. Piping System Changes

**Description of Change:** Remove misc piping system components - see design review for details.

16849	D&R	4 Crude	Zarbis, James T.	3/13/2007	Zarbis, James T.		1	2	3	
		Type: Permanent	Category: S/D	Expiration Date:						

**Project/Equipment Title:** CURE - Install Flanges for Constructability

**Description of Change:** Add valves to various piping systems for constructability and improved operation. Refer to design review for details.

16848	D&R	4 Crude	Zarbis, James T.	3/13/2007	Preciado, Silvano E.		1	2	3	
		Type: Permanent	Category: S/D	Expiration Date:						

**Project/Equipment Title:** CURE - TP1165A case drain steam traps modifications

**Description of Change:** Add flange sets on various piping systems for constructability, maintenance access, or hydrotest needs. See design review for details.

16841	D&R	4 Crude	Zarbis, James T.	3/8/2007	Curry, David P.		1	2	3	
		Type: Permanent	Category: Project	Expiration Date:						

**Project/Equipment Title:** CURE - reroute trap exhaust to 50# steam; originally going to 150# steam.

16835	D&R	4 Crude	Zarbis, James T.	3/8/2007	Curry, David P.		1	2	3	
		Type: Permanent	Category: Project	Expiration Date:						

**Project/Equipment Title:** CURE - demolition of soot blower panels / steam supply piping / power to panels

**Description of Change:** demolition of obsolete out of service piping and equipment damaged in the fire.

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
16830 D&R	4 Crude	Zarbis, James T.		3/8/2007	Preciado, Silvano E.		1	2	3	

Project/Equipment Title: CURE - Install wiring splice connections (as built drawings)

Description of Change: Capture changes on electrical one-line diagrams to show installation of wiring splice connections as needed to repair damaged wiring.  
MP-1105A, MP-1105, MP-1165, MP-1126A, 4CU CEMS shelter power supply

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
16829 D&R	4 Crude	Shockey, Gregory A.		3/8/2007	Curry, David P.		1	2	3	

Project/Equipment Title: CURE Change Air Supply From Utility Air to Instrument Air on VOC Chopper Valve 11XY003X

Description of Change: It was discovered that the following controllers in 4 Crude were controlled with utility air and need to be controlled using instrument air supply. Concern if the utility air supply is lost the controllers on that supply will go to their fail positions. Instrument air is a much more secure system and can be islanded in the refinery should utility air fail. At this time 11XY003X VOC Chopper Valve needs to be changed from utility air control to instrument air control. The CURE team will be correcting this issue.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
16790 D&R	4 Crude	Stock, Bryon D.		2/23/2007	Curry, David P.		1	2	3	

Project/Equipment Title: Upgrade 4 Crude Hot Oil Pump Washoil & Pumpout Spools & Install New Washoil PSV

Description of Change: In response to Additional Consideration (A/C) # 9 from the 4 Crude Fire Incident Investigation, the washoil and pumpout spool connections on all of the "hot oil" pumps will be upgraded. For this scope of work, hot oil has been defined as process streams that exceed 500F during normal operation and have the potential to contain sulfur or H2S.

Each spool will now match the process stream pipe class for its respective pump up to and including the second block valve. This upgrade will provide full-rated double block & bleed isolation between the process and the washoil or pumpout headers. This upgrade provides an inherently safe design that will allow the spools to remain in place permanently without risk of over-pressure or sulfidation corrosion.

Additionally, a new 3" X 4" PSV (C7-148) will be added to the vacuum washoil header to protect the 150# header from potential overpressure. #4 Crude Unit Procedure 4CU-NP-3050 step 2.1 instructs to "route a slip stream of washoil from the discharge of P-1165A through the washoil header into the discharge of P-1168 and P-1168A. During this operation the discharge pressure of P-1165A can exceed the washoil header pipe class pressure rating. The PSV will provide mechanical protection to ensure that equipment is operated within design limits at all times.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
16766 D&R	4 Crude	Walker, Kenneth B.		2/19/2007	Capshaw, Michelle L.		1	2	3	

Project/Equipment Title: 1st qtr T/A C1100

Description of Change: To ensure the safety of personnel working in two different areas of C1100 internals. Column is being divided for separate work in the bottom than what is being performed in the top (Hot Work in bottom creating CO). Bottom work is being done under supplied air and the top work is being done with half-face respirators with hepa/organic cartridges and personal CO monitors. The divider between the work is multiple layers of fire blankets. Minimum distance of 30 feet between the two zones.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
16765	D&R	4 Crude	Dillon, Craig R.	2/19/2007	Woolley, Scott J.		1	2	3	
		Type: Permanent	Category: S/D		Expiration Date:					
		Project/Equipment Title: Upgrade C-1100 Tray 48 Material to Monel								
		Description of Change: Existing 410SS lasted 4 years. Upgrade to monel should significantly increase tray life.								
16730	D&R	4 Crude	Baker, Frank L.	2/1/2007	Curry, David P.		1	2	3	
		Type: Permanent	Category: S/D		Expiration Date:					
		Project/Equipment Title: CURE - Removal of Piping Deadlegs								
		Description of Change: 1) Dismantle 3/4" threaded Fuel Gas line that was routed to instruments on C-1160 that were no longer in service prior to fire. The line and out of service instruments were damaged during no longer serves a purpose. 2) P1105 case vent header repair - remove deadleg on end of header in pipeway near P1105/A lateral. 3) N2 piping - remove 3" and 2" N2 drops east of P1165A, install one 2" drop at column 20.								
16722	D&R	4 Crude	Baker, Frank L.	1/30/2007	Curry, David P.		1	2	3	
		Type: Permanent	Category: S/D		Expiration Date:					
		Project/Equipment Title: CURE/ Replace section of Line SM1127-31-A-N7 that was damaged in fire, with 2" piping								
		Description of Change: Existing 3" line supplies a single 1.5" line. 2" is all that is required.								
16711	D&R	4 Crude	Curry, David P.	1/27/2007	Curry, David P.		1	2	3	
		Type: Temporary	Category: Leak Seal		Expiration Date: 3/28/2007					
		Project/Equipment Title: Wire wrap E-1100 inlet flanges-6 ea 6" & 6 ea 8"								
		Description of Change: The E-1100 fan fans have been blinded the blind flanges leak, most likley due to flange surface or pipe stress. TEAM will wire wrap the flanges to reduce and seal any vapor leak.The plant is shutdown and Operations is in the process of clean up								
		This Leak seal will be captured In MOC								
166932	D&R	4 Crude	Curry, David P.	1/23/2007	Curry, David P.		1	2	3	
		Type: Temporary	Category: Leak Seal		Expiration Date: 3/28/2007					
		Project/Equipment Title: Leak seal during clean up process for #4 CU								
		Description of Change: small leak on pump out header P-1158. TEAM will complete a fiberglass wrap. System requirements are pressure not to exceed 300# oil/water in system.								

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
166660 D&R	4 Crude	Greenfield, Matthew R.	1/10/2007 Curry, David P. <i>Confirmed up down</i>	Expiration Date:		2142	1	2	3	
Project/Equipment Title: 4CR - Y-1102 - PSV Drain Lines	Type: Permanent	Category: S/D								
Description of Change: Current setup allows 300F crude oil to release to the atmosphere in the event of a bellows seal failure on the PSV's. The released oil is a fire and safety hazard. The drain lines will correct this problem by routing the oil to a splash guard drain if there is a seal failure.										
16647 D&R	4 Crude	Mulakken, Nikki J.	1/4/2007 McGreevy, Donald E.	Expiration Date:		2142	1	2	3	
Project/Equipment Title: 480V MCC Starter Replacement	Type: Permanent	Category: S/D								
Description of Change: Cutler Hammer and IEM are unable to furnish a vertical busbar assembly in time for the shutdown. There are spare MCC cubicles that have enough room for a 480V bucket to be installed at that location. The existing bus can safely operate the other two starters that are presently attached to it. Leaving the busbar in place does not reduce the reliability of the MCC. An MOC is required due to the fact that the bucket will be connected to a separate part of the MCC.										
Total	30									

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15435 D&R	4 Crude	Post, Ronald W.	12/16/2005 Zarbis, James T.			1538	1	2	3	

**Project/Equipment Title:** Permanent Category: S/D Expiration Date:**Project/Equipment Title:** 4CU - V-1102 Mud Wash Modifications**Description of Change:** Improved mud wash operation will minimize plant upsets

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15434 D&R	4 Crude	Shotwell, Douglas M.	12/16/2005 Preciado, Silvano E.			1543	1	2	3	

**Project/Equipment Title:** Permanent Category: S/D Expiration Date:**Project/Equipment Title:** 4CU - C1160 Stripping Steam Sparger Installation**Description of Change:** Sparger is required to prevent "slugs" of water from entering Column C1160, as well as increase the area of stripping steam distribution.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15433 D&R	4 Crude	Shotwell, Douglas M.	12/16/2005 Preciado, Silvano E.			1542	1	2	3	

**Project/Equipment Title:** Permanent Category: S/D Expiration Date:**Project/Equipment Title:** 4CU - C1100 Stripping Steam Sparger Installation**Description of Change:** Spargers are required to prevent "slugs" of water from entering Column C1100, as well as increase the area of stripping steam distribution.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15426 D&R	4 Crude	Seidel, Bill M.	12/13/2005 Wilson, Clifford P.			1531	1	2	3	

**Project/Equipment Title:** Permanent Category: S/D Expiration Date:**Project/Equipment Title:** H2BC - K-900/K900A Piping - Add Valves for PRV Isolation**Description of Change:** Allow on the run maintenance for relief valves PSV-952 and PSV-953.

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15399 D&R	4 Crude	Shotwell, Douglas M.	11/28/2005 Zarbis, James T.			1506	1	2	3	

**Project/Equipment Title:** Permanent Category: S/D Expiration Date:**Project/Equipment Title:** 4CRUDE - V1190 Piping - Uptsize PSV-923 and Associated Piping**Description of Change:** Replacement is required per D&R Relief Study

No CRUDE  
V1190 Piping - Uptsize PSV-923 and Associated Piping  
Replacement is required per D&R Relief Study

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15358	D&R	4 Crude	Williamson, Richard V.	11/11/2005	Curry, David P.	1477	1	2	3	
		Type: Permanent	Category: Project		Expiration Date:					
		Project/Equipment Title: <u>E-1116A/F, isolation valves on PRDs</u>								
		Description of Change: Four PRDs protect the shell side and tube side of the two exchanger banks. These PRDs do not have isolation valves. This project installs a double-block-and-bleed arrangement for positive isolation of the heat exchangers on the run. The PRDs are provided with single block valves for isolation.								
15276	D&R	4 Crude	Samson, Jordan	10/24/2005	Curry, David P.	1981	1	2	3	
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: <u>4 CU - P1128/A - Upgrade Seal Flush Cooler to API Plan 23</u>								
		Description of Change: To eliminate the possibility of seal failure. The seal plan is being upgraded to API Plan 23 to improve seal cooler efficiency. The work order includes replacing the current cooler, rerouting the vent line upgrading the water line, and installing a stand alone bracket.								
15220	D&R	4 Crude	Dillon, Craig R.	10/3/2005	Curry, David P.	1409	1	2	3	
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: <u>E-1116 Thermal Relief Stopple Isolation</u>								
		Description of Change: The purpose of this work is to replace bundles A, B, D & E with upgraded 304L stainless steel bundles. Additionally, this change out will occur during a Crude Unit Slowdown. (taking bank D-F out of service and replacing D & E bundles). Once bank D-F is back in service, take out bank A - C and replace A & B bundles. In order to replace these bundles during a slowdown, stopples are required to provide isolation to the shellside and tubeside PSVs.								
15141	D&R	4 Crude	Curry, David P.	8/30/2005	Curry, David P.	1	1	2	3	
		Type: Temporary	Category: Routine		Expiration Date: 12/30/2006					
		Project/Equipment Title: <u>Open Bypass around 11FC-088</u>								
		Description of Change: Opening the bypass would allow for addational VBCR of about 5mhd which would help cool the overhead of C-1160 and increase vacuum valves.								
15079	D&R	4 Crude	Griffin, Charles T.	8/10/2005	Walker, Kenneth B.	1	1	2	3	
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: <u>Convert DEBRU Surge Box PC - 42PC012 from split range controller to 2 separate PCs.</u>								
		Description of Change: Allow for better control and reduce chance of inadvertent N2 makeup to DEBRU. The PC's would use the same PV indication but operate separate valves.								

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15019	D&R	4 Crude	Phipps, Daniel H.	7/18/2005	Walker, Kenneth B.					
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: C-1190 Overhead Gas Chromatograph Sample Return Tubing.								
		Description of Change: This will improve the accuracy and reliability of the C-1190 overhead gas chromatograph.								
14946	D&R	4 Crude	Simmers, Carl B.	6/24/2005	Smith, Scott A.					
		Type: Temporary	Category: Leak Seal		Expiration Date: 12/31/2006					
		Project/Equipment Title: K-1171 and associated equipment -- Relief Header Leak								
		Description of Change: Leak on relief header K-1171 platform -- 8" TEE Ties into relief header leak at the bottom of the TEE. Add temporary band clamp (skinner clamp) to vertical piece approx 4" up the pipe.								
14709	D&R	4 Crude	Towell, Allen M.	4/14/2005	Curry, David P.					
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: Replace/resize V1103 ofgas orifice								
		Description of Change: This orifice has up to a 10 psig non-recoverable pressure drop. It is undersized.								
14708	D&R	4 Crude	Towell, Allen M.	4/14/2005	Curry, David P.					
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: Replace E1115 flow orifice								
		Description of Change: Current orifice is undersized.								
14535	D&R	4 Crude	Phipps, Daniel H.	3/10/2005	Walker, Kenneth B.					
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: P-1167 Suction Pressure Switches								
		Description of Change: To improve the reliability of P-1167 by replacing the pump suction low pressure and high pressure switches with units containing sealed leads as well as shortening the piping leading to the switches minimizing the plugging with resid that causes the switches to be ineffective.								

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
14455 D&R	4 Crude	Miller II, Mark A.	Curry, David P.	2/21/2005	Curry, David P.	11111	1	2	3	
Project/Equipment Title:	Permanent	Category: Routine	Expiration Date:							
Description of Change:	Electronic EWO 1111 generated from old EWO # EK-62673									
14363 D&R	4 Crude	Towell, Allen M.	1/26/2005 Walker, Kenneth B.			1	2	3		
Project/Equipment Title:	Permanent	Category: Routine	Expiration Date:							
Description of Change:	Change Alarm Point on 42PDD015									
14353 D&R	4 Crude	Curry, David P.	1/25/2005 Curry, David P.			1	2	3		
Project/Equipment Title:	Temporary	Category: Leak Seal	Expiration Date: 12/31/2006							
Description of Change:	Seal leak on wash out / pump out header at #4 CU									
	Total	18								

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
16547	D&R	4 Crude	Curry, David P.	11/21/2006	Curry, David P.		1	2	3	
	Type: Temporary	Category: Leak Seal		Expiration Date: 3/15/2007						
	Project/Equipment Title: Thin spot on C-1160 OHHD 24" line - It's .075 and we want to fiberglass wrap. It operates at 23.1 INHG									
	Description of Change: thin spot .075 on the 24" line	THIS HAS BEEN COMPLETED - REPAIRS MADE ON 2007 SHUTDOWN								
16509	D&R	4 Crude	Shotwell, Douglas M.	11/7/2006	Zarbis, James T.		2076	1	2	3
	Type: Temporary	Category: S/D		Expiration Date: 12/30/2006						
	Project/Equipment Title: 4CU SD 1Q/07 Flow Test C-1160 Procedure									
	Description of Change: The Flow Test of the column will require personnel to be in the column while 2200 GPM of water is pushed through the new VTCR Trough Distributor and VBCR Spray Nozzle Distributor. Variance for 9520									
16488	D&R	4 Crude	Smith, Robert L.	11/1/2006	Capshaw, Michelle L.		1	2	3	
	Type: Permanent	Category: Routine		Expiration Date:						
	Project/Equipment Title: E-1128 Decking Upgrades									
	Description of Change: Deck expansion required for maintenance accessibility. A safety corrective action.									
16411	D&R	4 Crude	Cabrera, Jaime	10/4/2006	Zarbis, James T.		1868	1	2	3
	Type: Permanent	Category: Project		Expiration Date:						
	Project/Equipment Title: #4 Crude - Control Power Modifications & Upgrades to 2400volt Swgr 11A-1A and 11B-1B									
	Description of Change: An unplanned shutdown of #4 crude unit due to the May 10, 2006 Quary Feeder cable fault led to the discovery of the failed throw-over control panel that feeds 120/240volt control power to swgr breakers, sp heaters, and protective relays on TX-267/268 busses 11A-1A and 11B-1B. The solution is to make modifications and upgrades to the throw-over panel by adding manual testing of the throw-over panel scheme. Periodic testing will ensure correct operation of the throw-over panel and detect early failure for preventative measures on future unplanned shutdowns. Additional mods. and upgrades are discussed in EWO #1868. This work will be performed in the 2007 1Q #4 Crude SD.									
16256	D&R	4 Crude	Hulse, Benjamin	8/23/2006	Preciado, Silvano E.		1938	1	2	3
	Type: Permanent	Category: S/D		Expiration Date:						
	Project/Equipment Title: 4CU - 4 S/C Pump Seal Flush Piping Modifications									
	Description of Change: Replace 20 LF of 3/4" API pump seal flush piping to P-1168A. Add new flange pairs and a block valve to give maintenance the ability to isolate and unplug when necessary.									

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MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
16217 D&R	4 Crude	Mulakken, Nikil J.	8/10/2006 Curry, David P.	1935	1	2	3			
Project/Equipment Title:	Temporary	Category: Routine	Expiration Date: 12/24/2008							
Description of Change:	A second Star Conn trailer needs to be powered by a temporary generator. A separate generator will be installed due to limitations on transformer sizes connected to power centers available.									
16183 D&R	4 Crude	Curry, David P.	8/1/2006 Curry, David P.				1	2	3	
Project/Equipment Title:	Temporary	Category: Leak Seal	Expiration Date: 3/1/2007							
Description of Change:	Condensate line leak repair									
16157 D&R	4 Crude	Curry, David P.	7/25/2006 Curry, David P.				1	2	3	
Project/Equipment Title:	Temporary	Category: S/D	Expiration Date: 3/1/2007							
Description of Change:	K-1196 Fuel Gas blowdown line									
		The block valve for the K-1196 blowdown line can only be closed by having a machinist drive the stem closed. This MOC is to add Stainless steel tubing to the bleeders and bypass the Bad valve. This would allow operations to blow down the vessel and to isolate the vessel from relief when complete								
16028 D&R	4 Crude	Walker, Kenneth B.	6/9/2006 Curry, David P.				1	2	3	
Project/Equipment Title:	K-1171A 1st stage discharge / PRD #C7-53	Category: S/D	Expiration Date: 2/18/2007							
Description of Change:	The last service date for C7-53 was 7/18/2000, and is on a 72 month (5 Year) service frequency. This last service occurred when live relief work was ok'ed for servicing of PRD's. Due to tighter environmental regs and increased safety awareness, live relief work is being minimized in the refinery. Because of this new mindset we will invoke the 11.0% rule described in section 4.5 of RI-609 and extending the next service date 2/18/2007. We will then service PRD #C7-53 during the 1st Quarter 2007 4CU T/A scheduled for January 2007.									
15981 D&R	4 Crude	Curry, David P.	5/24/2006 Curry, David P.				1	2	3	
Project/Equipment Title:	Emergency/Temporary	Category: Routine	Expiration Date: 6/10/2006							
Description of Change:	Connect ram pump to wash out header at the K-1165's to clean out the line									

# MOC status

7/1/2009 10:28:36 AM

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15925 D&R		4 Crude	Dillon, Craig R.	5/4/2006	Preciado, Silvano E.	1599	1	2	3	
		Type: Permanent	Category: S/D		Expiration Date:					
		Project/Equipment Title: 4CU - Piping - Upgrade 4S/C Piping to 9Cr								
		Description of Change: Existing line is carbon steel in a hot service that operates in the range where high temperature sulfidation occurs. The line has been ut Inspected (Reco 4CUSd6_7-1 and 2 and Rec-43113) and found to be nearing tmin requiring replacement. Due to the higher temperature 9Cr would be the preferred material.								
15891 D&R		4 Crude	Griffin, Charles T.	4/27/2006	Walker, Kenneth B.		1	2	3	
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: Autodefeat point alarms during analyzer calibration								
		Description of Change: Process Point alarms during analyzer calibration are an unnecessary nuisance as the reading has no meaning regarding the actual process value during calibration. As part of a larger effort to reduce nuisance alarms, a Honeywell Logic block will be built to defeat process alarms during calibration. This MOC will cover all furnace analyzers (both in the Crude Unit and the G/DHT) and the H2S in fuel gas analyzer. The analyzer call alarms will also be given a journal priority for the same reason.								
15851 D&R		4 Crude	Walker, Kenneth B.	4/13/2006	Curry, David P.		1	2	3	
		Type: Temporary	Category: Leak Seal		Expiration Date: 2/1/2007					
		Project/Equipment Title: E-1101A has a leak on the bottom outlet flange								
		Description of Change: To secure flange leak that cannot be permanently repaired until the 1st quarter 2007 Plant Turnaround.								
15550 D&R		4 Crude	Curry, David P.	1/28/2006	Curry, David P.		1	2	3	
		Type: Temporary	Category: Leak Seal		Expiration Date: 4/30/2007					
		Project/Equipment Title: Install and Inject 10" line enclosure on the top deck of K-1171.								
		Description of Change: Line cannot be taken out of service on the run. An on-line leak repair will be made using a bolt on enclosure. The leak has been stopped usig fiberglass wrap, the bolt on clamp is on site and awaiting approval to install.								
15522 D&R		4 Crude	Williamson, Richard V.	1/18/2006	Preciado, Silvano E.		1616	1	2	3
		Type: Permanent	Category: S/D		Expiration Date:					
		Project/Equipment Title: V-1190 REPLACEMENT (with design pressure upgrade)								
		Description of Change: Inspection recommendation -- D-5898. Recognition that the design pressure of V-1190 is below the set pressure of all PSVs on the stabilizer overhead system.								
		Operations has requested that no flanges be installed in relief or process lines.								

# MOC Status

7/1/2009 10:28:36 AM

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15518	D&R	4 Crude	Jolly, Garth D.	1/18/2006	Preciado, Silvano E.	1627	1	2	3	
		Type: Permanent	Category: S/D		Expiration Date:					
		Project/Equipment Title: <u>4CU - C-1100 Replace ATCR Trays 35-37</u>								
		Description of Change: Section of column between ATCR draw and return has a high liquid flow rate, leading to liquid hold up and pressure drop issues. Trays with larger downcomer area will be installed to reduce pressure drop through the column.								
15513	D&R	4 Crude	Carrillo, Jose A.	1/17/2006	Zarbis, James T.	1622	1	2	3	
		Type: Permanent	Category: S/D		Expiration Date:					
		Project/Equipment Title: <u>4CU - C-1100 Piping - Upgrade Overhead Piping</u>								
		Description of Change: High corrosion rates have been identified in the C-1100 overhead piping system, mainly in two different areas. The two areas are just downstream of the "Y" section past the water injection and the header into the E-1101 exchangers. Chevron experts determined that the solution for the corrosion mechanism(s) is Hastelloy C-276. The scope of the work is to replace the piping/fittings mentioned with C.S. (w/ Hastelloy C-276 clad and/or weld-overlay), solid Hastelloy C-276 pipe/fittings and block valves w/ Hastelloy C-276 weld-overlay trim.								
15505	D&R	4 Crude	Jolly, Garth D.	1/16/2006	Zarbis, James T.	1610	1	2	3	
		Type: Permanent	Category: Routine		Expiration Date:					
		Project/Equipment Title: <u>4CU - C-1100 Replace Stripping Trays</u>								
		Description of Change: 10 gauge thickness trays will help resist buckling from steam surges. (Potential for buckling will also be minimized by the installation of a steam sparger under a different EWO.) Fixed valves were chosen for both their increased efficiency and benefit of improved stiffness of the tray relative to the existing sieve tray design.								
15499	D&R	4 Crude	Kuo, Minghuei	1/16/2006	Preciado, Silvano E.	1608	1	2	3	
		Type: Permanent	Category: S/D		Expiration Date:					
		Project/Equipment Title: <u>Install Stub outs for Fuel Gas Heater</u>								
		Description of Change: The Fuel Gas Heater project is to improve the 4 CRude furnaces operation to prevent the burners from plugging.								
15482	D&R	4 Crude	Kuo, Minghuei	1/10/2006	Preciado, Silvano E.	1585	1	2	3	
		Type: Permanent	Category: S/D		Expiration Date:					
		Project/Equipment Title: <u>4CU - Piping - Install two flow orifices on #7S/C pump seal flush</u>								
		Description of Change: To monitor the #7S/C flow to the pump's seal flush.								

**MOC Status**

7/1/2009 10:28:37 AM

MOC Number	ABU	Plant	Originator	Date Issued	Section Two Reviewer	EWO ID	Stage 1	Stage 2	Stage 3	Cancelled
15465	D&R	4 Crude	Williamson, Richard V.	1/4/2006	Preciado, Silvano E.	1560	1	2	3	
		Type: Permanent	Category: S/D	Expiration Date:						
Project/Equipment Title: C-1160 AMMONIA INJECTION MODIFICATIONS										
		Description of Change: Move the ammonia injection point from the vessel to the inlet of the overhead vapor eductors. Four new injection quills installed in eductor inlets.								
15456	D&R	4 Crude	Williamson, Richard V.	1/4/2006	Preciado, Silvano E.	1557	1	2	3	
		Type: Permanent	Category: S/D	Expiration Date:						
Project/Equipment Title: C-1100 AMMONIA INJECTION MODIFICATIONS										
		Description of Change: Corrosion prevention recommendation.								
		M R No. 00203121								
Total 22										

#4 crude

# Investigation List Summary

## Richmond Refinery

Menu	Form	MITS#	Incident Date	Reporting Area	Title of Event	Status
33		MITS-2007-1686	3/30/07	D&R ABU	Flaring - plant s/u activity (113134)	Compl
34		MITS-2007-1683	6/19/07	D&R ABU	Possible flaring event (111725)	Compl
35		MITS-2007-1656	6/11/07	D&R ABU	Loss of seal flush - plant upset (111593)	Compl
36		MITS-2007-1655	6/11/07	D&R ABU	Temporary loss of 8 s/c feed to RLOP HNC	Compl
37		MITS-2007-1576	5/4/07	D&R ABU	Possible Knee Injury (109190)	Compl
38		MITS-2007-1547	4/23/07	D&R ABU	Furnace trip due to failed fuse to FSC cards	Compl
39		MITS-2007-1542	4/19/07	D&R ABU	Near Miss - Safeties lifted on BFW system at	Compl
40		MITS-2007-1541	4/19/07	D&R ABU	Steam Pressure swings loss of K-1600 and	Compl
41		MITS-2007-1507	4/11/07	D&R ABU	Near Miss (107854)	Compl
42		MITS-2007-1499	4/3/07	D&R ABU	HC odor by E-1190 C1/C2 /Fan S/D/ Flaring	Compl
43		MITS-2007-1485	4/1/07	D&R ABU	Leaking nipple caused small fire at 4 CU	Compl
44		MITS-2007-1483	3/31/07	D&R ABU	Oil to 2 Sep from 4 CU Desalter (106936)	Compl
45		MITS-2007-1435	3/10/07	D&R ABU	Contract Engineer Struck on Hard Hat by	Compl
46		MITS-2007-1400	3/4/07	D&R ABU	D&R Fare activity (105379)	Compl
47		MITS-2007-1380	2/26/07	D&R ABU	DEA to Sour Water from 5 H2S (105097)	Compl
48		MITS-2007-1367	2/23/07	D&R ABU	F-1160 CO2 blasting (104839)	Compl
49		MITS-2007-1360	2/13/07	D&R ABU	Missed Flare sample 20:40 hours (104353)	Compl
50		MITS-2007-1332	2/18/07	D&R ABU	BENZENE / LEL EXPOSURE (104147)	Compl
51		MITS-2007-1328	2/17/07	D&R ABU	Smoldering trash can (104133)	Compl
52		MITS-2007-1326	1/15/07	D&R ABU	Additional Considerations from 1/15/07	Compl
53		MITS-2007-1321	2/13/07	D&R ABU	Near Miss - falling tool - (Red Hat notes)	Compl
54		MITS-2007-1320	2/13/07	D&R ABU	Near Miss - Falling Object (Red Hat notes)	Compl
55		MITS-2007-1319	2/14/07	D&R ABU	Near Miss - Dropped Pin Bar (Red Hat	Compl
56		MITS-2007-1287	2/8/07	D&R ABU	Employee injured falling from bike (103167)	Compl
57		MITS-2007-1285	2/7/07	D&R ABU	Possible Benzene Exposure (103163)	Compl
58		MITS-2007-1250	2/4/07	D&R ABU	CVX EE burn to right palm (103088)	Compl
59		MITS-2007-1240	2/1/07	D&R ABU	First aid Employee cut finger (103103)	Compl
60		MITS-2007-1147	1/21/07	D&R ABU	(D&R East Odor Smelled (102110)	Compl
61		MITS-2007-1134	1/19/07	D&R ABU	Packing leak fuel gas isolation valve	Compl
62		MITS-2006-952	9/29/06	D&R ABU	Loss of MP-1601	Compl
63		MITS-2006-941	9/25/06	D&R ABU	Loss of K1600	Compl
64		MITS-2006-903	8/30/06	D&R ABU	Flaring at LSFO flare - C1190 off gas and	Compl

# Investigation List Summary

## Richmond Refinery

Menu	Form	MITS#	Incident Date	Reporting Area	Title of Event	Status
65		MITS-2006-891	7/21/06	D&R ABU	Flaring at LSFO flare (92366)	Compl
66		MITS-2006-860	8/9/06	D&R ABU	Flaring at LSFO Flare (92833)	Compl
67		MITS-2006-849	8/8/06	D&R ABU	Sour Water leak	Compl
68		MITS-2006-761	6/3/06	D&R ABU	F-1100A pass#4 loss of flow (Min fire chop).	Compl
69		MITS-2006-742	5/18/06	D&R ABU	Loss of 4 S/C at Crude Unit	Compl
70		MITS-2006-587	2/26/06	D&R ABU	DHT/K1600 S/D	Compl
71		MITS-2006-468	1/13/06	D&R ABU	Operator sprayed with sour water, DHT (00015)	Compl
72		MITS-2006-388	4/28/05	D&R ABU	D&R MP-1601 damaged during startup	Compl
73		MITS-2006-1069	12/8/06	D&R ABU	C-1160 loss of vacuum (101809)	Compl
74		MITS-2006-1045	11/22/06	D&R ABU	Crude Unit Electrical failure on TX 278 "B"	Compl
75		MITS-2005-57	7/13/05	D&R ABU	spot burns to lip and right cheek incurred	Compl
76		MITS-2005-301	7/20/05	D&R ABU	#5 H2S Rich DEA Line Leak	Compl
77		MITS-2005-14	12/1/05	D&R ABU	Personnel Exposure	Compl

# Investigation List Summary

## Richmond Refinery

Menu	Form	MITS#	Incident Date	Reporting Area	Title of Event	Status
1		MITS-2008-2658	5/13/08	D&R ABU	Cut finger - First aid (*)	Compl
2		MITS-2008-2653	5/11/08	D&R ABU	Relief gas flow to D&R Flare (*)	Compl
3		MITS-2008-2645	5/7/08	D&R ABU	MVA, East side van backed into pipe support	Compl
4		MITS-2008-2612	5/1/08	D&R ABU	MVA (*)	Compl
5		MITS-2008-2553	4/11/08	D&R ABU	Heat of the day/Feed composition - Minor	Compl
6		MITS-2008-2479	3/11/08	D&R ABU	Debris V-3212 isolated due to vapors from	Compl
7		MITS-2008-2328	1/29/08	D&R ABU	K3950 Shutdown Twice (*)	Compl
8		MITS-2007-2224	12/31/07	D&R ABU	K3950 Shutdown (136653)	Compl
9		MITS-2007-2221	12/28/07	D&R ABU	LOSS OF K-1171 (136650)	Compl
10		MITS-2007-2209	12/24/07	D&R ABU	K-3950...spillback line had possible ice	Compl
11		MITS-2007-2207	12/22/07	D&R ABU	k-3950 s/d on low suction pressure (136635)	Compl
12		MITS-2007-2206	12/21/07	D&R ABU	F3901 (136629)	Compl
13		MITS-2007-2202	12/20/07	D&R ABU	Packing leak off K1171A vent gas and relief	Compl
14		MITS-2007-2156	12/4/07	D&R ABU	K-3950 S/D due to hi level in V-3951A K/O	Compl
15		MITS-2007-2146	11/29/07	D&R ABU	Loss of K3950 Flare Gas Recovery	Compl
16		MITS-2007-2144	11/28/07	D&R ABU	Near Miss Crude Unit Vac Bottoms Valve	Compl
17		MITS-2007-2130	11/27/07	D&R ABU	V-3900 flow to flare (135031)	Compl
18		MITS-2007-2120	11/22/07	D&R ABU	K1100B Shutdown (134646)	Compl
19		MITS-2007-2087	11/15/07	D&R ABU	K-3950 S/D due to low pressure in system	Compl
20		MITS-2007-2058	11/7/07	D&R ABU	Excessive flow to relief system (131804)	Compl
21		MITS-2007-2029	10/31/07	D&R ABU	Oil Spill (128222) <i>check valve failure</i>	Compl
22		MITS-2007-2000	10/23/07	D&R ABU	Strained Shoulder (122332)	Compl
23		MITS-2007-1939	10/2/07	D&R ABU	flare event (117565)	Compl
24		MITS-2007-1908	9/21/07	D&R ABU	C1190 Off gas excursion (117030)	Compl
25		MITS-2007-1898	9/19/07	D&R ABU	Ups System failure (116928)	Compl
26		MITS-2007-1887	9/16/07	D&R ABU	Potential Flaring D&R (116844)	Compl
27		MITS-2007-1804	8/14/07	D&R ABU	Flow to D&R Flare short duration (114877)	Compl
28		MITS-2007-1704	6/28/07	D&R ABU	Loss of Vacuum column indications during X-	Compl
29		MITS-2007-1699	6/27/07	D&R ABU	Ground fire reported at D&R flare (113162)	Compl
30		MITS-2007-1697	6/27/07	D&R ABU	Vacuum Column Upset (113202)	Compl
31		MITS-2007-1696	6/26/07	D&R ABU	Flaring during the lighting of the flare pilot	Compl
32		MITS-2007-1695	6/25/07	D&R ABU	Loss of K1100B mystery shutdown (113157)	Compl



# Investigation Summary Report

Richmond Refinery

Special Instructions

Incident # **MITS-2005-57**

Status **Complete**

## Incident/Event Information

Event Date	<b>Wednesday, July 13, 2005</b>			Reporting Company	<b>CHEVRON PRODUCTS COMPANY</b>		
Event Time	24 Hr.	<b>0900</b>	Standard	<b>9:00 AM</b>	Facility	<b>Richmond Refinery</b>	
Event End Date	<b>Wednesday, July 13, 2005</b>			Reporting Area	<b>D&amp;R ABU</b>		
Event End Time	24 Hr.	<input type="text"/>	Standard	<input type="text"/>	Section	<b>D&amp;R East</b>	
Mgmt Sponsor	<b>Mark Miller*</b>			Crew/Group	<b>A</b>		
Incident Type	<b>Safety</b>			Locations Impacted	<input type="text"/>		
Maintenance Focus	<b>None</b>			Impacted Plant	<input type="text"/>		
Affected Equipment	<b>Not Applicable</b>						

When did you find out about the event? Time  Date

Event Title **spot burns to lip and right cheek incurred while pulling resid sample at #4 Crude Unit**

Description The Operator put on the proper PPE. He started to unblock the inline sample valve which requires 82 count hand crank turns before receiving stock. Operator viewed sample tap through viewing port on sample enclosure. Initially no product came out after reaching 82 turns. With enclosure still closed, operator exercised sample draw by backing off on sample valve and reopening two times while observing sample draw through view port. Due to difficulty in seeing inside enclosure, operator opened side door to get a better view. on the third cycle of

Event Classification	Near Miss: <input type="radio"/> Yes <input checked="" type="radio"/> No	PSM Near Miss: <input type="radio"/> Yes <input checked="" type="radio"/> No	MCAR Near Miss: <input type="radio"/> Yes <input checked="" type="radio"/> No
Category	<b>PERSONAL INJURY</b>		NSR Consent Decree <input type="radio"/> Yes <input checked="" type="radio"/> No
Type	<b>First Aid</b>		
	Level <b>Level 1</b>		

Menu

New Record

Find



Sort



List

II Report

Print

**Minor Investigation Tracking System**

Richmond Refinery

MITS Incident # **MITS-2007-1126**Status **Complete****Incident/Event Information**Event Date **Monday, January 15, 2007**Reporting Company **CHEVRON PRODUCTS COMPANY**Event Time 24 Hr. **0518** Standard **5:18 AM**Facility **Richmond Refinery**Event End Date **Monday, January 15, 2007**Reporting Area **D&R ABU**Event End Time 24 Hr. **1723** Standard **5:23 PM**Section **D&R General**Mgmt Sponsor **Carl Simmers**

Crew/Group

Incident Type **Process**Locations Impacted **#4 Crude**Maintenance Focus **Reliability**Impacted Plant **#4 Crude**Affected Equipment **Rotating**

When did you find out about the event?

24 Hr. **05:20**Time **5:20 AM**Date **Monday, January 15, 2007**Event Title **Fire at #4 Crude Unit - CWS Level 3 Event (101764)**Description This investigation is being conducted under attorney-client privilege.  
For more information contact the Refinery Incident Coordinator: Mike Baer at 242-3567.

Event Classification

Near Miss:  Yes  NoPSM Near Miss:  Yes  NoMCAR Near Miss:  Yes  No

Category

**REPUTATION**NSR Consent Decree  Yes  NoLevel **Level 3b**

Type

**Incidents reportable to outside agencies and requiring or threatening shut down of operations**

How did you find out about the incident/event?

**This investigation was conducted under attorney-client privilege.  
The publicly available report is attached.  
For more information contact Matt Brennan x21862.**

Describe the steps taken to correct or mitigate the problem:



Describe the steps taken to reduce emissions caused by the Incident/event:

Investigation:

Samples Taken?  Yes  No 24 Hr. Time: Tag Number:

Were any other Divisions/Areas Affected?  Yes  No

Impact to other Divisions/Areas:

[Large empty rectangular box for notes]

Action Taken:

[Large empty rectangular box for notes]

NSRCD No

Last Modified

Tery Lizarraga  
Manager, Health, Environmental  
and Safety

Chevron Products Company  
Richmond Refinery  
841 Chevron Way,  
Richmond, CA  
94801  
Tel 510-242-1400  
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[hink@chevron.com](mailto:hink@chevron.com)

April 18, 2007

Randall L. Sawyer  
Hazardous Materials Program Director  
Contra Costa Health Services Department  
4333 Pacheco Boulevard  
Martinez, CA 94553-2229

Dear Mr. Sawyer,

Enclosed is the final investigation report of the fire that occurred on Monday, January 15, 2007 in the crude unit at the Chevron Richmond Refinery. The report describes the events leading up to the incident and the corrective actions we have taken and are planning to take. Curtis Anderson, General Manager of the Richmond Refinery, and I want to assure you and the community that the Richmond Refinery is committed to safe and reliable operations.

In the attached report, please note the investigation team concluded the initiating event was the failure of a thinned carbon steel section of the swing out wash oil pipe spool that was left connected to process plant equipment for a lengthy period of time. The wash oil system is a temporary, infrequently used system to clean-up equipment prior to maintenance. A contributing factor identified that valve seats were missing from the gate valve that separates the wash oil pipe spool from the plant equipment. When an adjacent pump was started up, the missing seats allowed full pump discharge pressure into the wash oil pipe spool causing the failure of a section of that pipe spool.

The Refinery has completed all repairs and the crude unit (CU) is now fully operational. Based upon the investigation team's findings, we have identified the proper corrective actions to prevent a recurrence, including the installation of upgraded pipe metallurgy/design in the CU for an Inherently Safer Solution. As noted in the attached report, we have completed the key corrective actions to address the root causes of the incident.

Again, we want to emphasize that Chevron is committed to incident and injury free operations. As part of Chevron's Operational Excellence Management System we have shared the investigation results throughout Chevron's Global Refining system.

If you have any questions please contact myself or Matt Brennan at 510 242 1862.

*Tery Lizarraga*

Tery Lizarraga

Enclosure: Final Report

CC: BAAQMD – Brad Kino, Cal/OSHA - Tom Johnston, City of Richmond - Kathryn Gerk

### Description of What Occurred

The refinery crude unit was being prepared for scheduled maintenance. As pump P-1165A was started, a release occurred from a swing out wash oil pipe spool when a section of that spool failed. The material released was a mixture of wash oil<sup>1</sup>, and partially processed crude oil. Within several seconds, at 05:18 AM, the mixture ignited resulting in first aid burns to an operator. Due to the fire's potential off-site impact, Chevron initiated a Contra Costa Health Services (CCHS) Community Warning System (CWS) Level 2 notification at 05:22 AM. Shortly thereafter, at 05:30 AM, a CWS Level 3 was issued to portions of the community alerting people to shelter in place. The main fire was extinguished at 07:00 AM and CCHS announced the CWS all clear at 8:40 AM. For safety reasons (to not accumulate quantities of unburned vapor) several small fires were allowed to continue in a controlled manner until 14:14 PM on the same day.

### Investigation Team

The investigation was facilitated by a Chevron Corporate Fire and Process Safety Engineer and led by Chevron Pascagoula Refinery Area Business Leader. Other core team member positions included a Chevron Pascagoula Refinery Designs Team Leader and the following from the Richmond Refinery: a plant Operating Assistant, two Head Operators, who are also United Steel Worker Union Health and Safety Representatives, and a Corporate Crude Unit subject matter expert. Additional experts were involved in the analysis of the incident and the investigation on an as needed basis.

### Investigation Methodology

The team followed a proprietary root cause analysis methodology, TapRooT®, developed by System Improvements, Inc. of Knoxville TN. The TapRooT® investigation process requires the systematic evaluation of each causal factor against a structured hierarchy, called the Root Cause Tree®. The Root Cause Tree consists of a series of questions relating to individual performance, team performance and management systems that lead to a set of Basic Cause Categories. Within each Basic Cause Category are a number of unique root causes, as defined by Systems Improvement, Inc.

### Causes

**Primary Cause:** Per original plant design the pipe spool for connecting wash oil to the discharge of the pump is a swing out type, which was not intended to be connected to the pump discharge line during normal operation. Instead, the spool was connected to the discharge of the pump for an extended period of time. Leaving the swing out wash oil pipe spool connected to the discharge of the pump allowed the spool to be exposed to process conditions. Metallurgical testing and analysis indicate that the failed section of the spool was thinned by high temperature sulfidation corrosion.

**Contributing Cause:** The gate valve off P-1165A discharge line was missing its valve seats. The pump startup allowed full pump discharge pressure to enter and rupture the thinned section of the spool. While modeling did not show that the missing seats alone caused corrosion to occur, the missing seats are believed to have contributed to process conditions that allowed sulfidation corrosion and thinning of the spool to occur.

<sup>1</sup> Wash oil is basically diesel fuel that is used to remove heavier crude oil residue from the internals of equipment in preparation for equipment clean-up and maintenance.

## **Root Causes (as defined in the Tap Root® methodology) & Corrective Actions:**

Causal Factor No. 1: Swing out wash oil spool connected to the discharge of pump P-1165A was connected for a lengthy period of time (20+ years).

Background: Swing out wash oil spool was left connected to plant pipe without going through a thorough evaluation utilizing a formal Management of Change process prior to updating plant Piping and Instrumentation Diagrams (P&IDs).

Root Cause: Management System -Standards, Policies or Administrative Controls (SPAC) Confusing or Incomplete.

Note: Confusing or incomplete infers the existing SPAC (procedures), used at that time, did not fully address/specify what actions/steps were needed at the time changes to this equipment configuration took place.

### Corrective Actions & Status:

1. Determine the integrity of the swing out wash oil spools at all hot oil pumps in the Crude Unit and repair or replace as necessary. Utilizing the MOC process, change the design for permanent installation of the spools or implement operating procedures to ensure those spools at all hot oil pumps in the Crude Unit are disconnected or blinded at the first block valve off the pump during normal unit operation. Ensure the plant P&IDs reflect this design.  
Richmond implemented the Inherently Safer Solution: Upgraded wash oil pipe spool metallurgy/design in the Crude Unit for permanent installation, eliminating the potential for sulfidation corrosion.

Status: Complete OK

2. It is believed that the change in operation of the spool occurred before the Refinery instituted a more rigorous Management of Change (MOC) process in 1993 to ensure that changes (other than in-kind) are evaluated and approved prior to implementation of such changes in the field. The MOC process would have identified the implications of the technical and health and safety impacts of this type of change.

Status: Complete OK

3. Reinforce that field conditions which are found that do not match existing P&IDs use the MOC process to verify P&ID changes are fully evaluated prior to changing such documentation.

Status: Complete OK

4. Send communication to Chevron Global Refining Operations and Reliability Managers to evaluate metallurgical specification breaks at all hot oil (>475 °F) pumps, with emphasis on positive isolation at specification break points.

Estimated Completion Date: 5/31/07

*Various communications made throughout company. Document reviewed  
status complete*

5. Identify (refinery wide) existing swing out spools and verify they are still being operated as such, or ensure a proper design review has been conducted for changed operation.

Estimated Completion Date: 5/31/07

*Need to confirm. documents reviewed  
status complete*

Causal Factor No. 2: Seats missing in the 4-inch 5 Chrome gate valve at the wash oil connection point off of the discharge of P-1165A.

Background: The Richmond Refinery was not able to determine if the valve was received from the manufacturer with missing seats, or if repairs were made to the valve and the seats were not reinstalled.

Root Cause: Manufacturing or Quality Control: Unable to Determine.

Note: The TapRooT® process specifies "unable to determine" if the root cause is not conclusive. Below, Chevron has identified corrective actions that would prevent a recurrence if the basic cause was either manufacturing or quality control related.

Corrective Actions & Status:

1. Replace the valve on P-1165A discharge piping to wash oil pipe spool.  
Status: Complete. *OK*
2. Chevron Global Procurement to ensure contract language requires valve suppliers to administer quality control checks for proper assembly of new valves and that procedures include a seat tightness hydrotest for all existing valves undergoing repairs by third party valve repair shops. This applies to existing and new contracts.  
Estimated Completion Date: 01/31/08
3. Richmond Refinery Machine Shop to ensure their procedure includes a seat tightness hydrotest for all valves undergoing trim modifications or repairs by the Refinery machine shop.  
Estimated Completion Date: 05/31/07
4. Communicate the recommendation that all Chevron Refining machine shops ensure procedures include a seat tightness hydrotest for all valves undergoing trim modifications or repairs by the Refinery machine shops.  
Estimated Completion Date: 7/31/07

## Additional Information that Demonstrates Regulatory Compliance

**Date & Time Event Began:** Monday, January 15, 2007, 05:18AM

**Date & Time Safe and Controlled Conditions Were Established:** Fire under control and CCHS Community Warning System all clear sounded at 08:40AM, January 15, 2007 (controlled burning of several small leaks remained to prevent accumulation of flammable vapors). All fires extinguished January 15, 2007, 14:14PM

**Date & Time Investigation Started:** January 15, 2007, 07:00AM.

**Type of Incident:** CWS Level 3

**Cost of Incident:** Greater than \$500,000

**Chemicals released:** The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Emergency Planning and Community Right-To-Know Act (EPCRA) require reporting when a facility releases more than a "reportable quantity" of a hazardous substance. The reportable release thresholds are based upon EPCRA & CERCLA reporting requirements. No materials released exceeded these reporting thresholds. Final calculations of the total materials released are noted below, which are a result of the materials combusted during the fire:

Material Released	Quantity Released	Reportable Release Thresholds	CAS Number	MSDS Number
Sulfur Dioxide (SO <sub>2</sub> )	377 pounds	500 pounds	7446-09-5	CVX - 584
Nitric Oxides (NO <sub>x</sub> )	34 pounds	1,000 pounds	10102-43-9	CVX -11185
Sulfuric Acid (H <sub>2</sub> SO <sub>4</sub> )	6 pounds	1,000 pounds	7664-93-9	GC-V01011
Hydrogen Sulfide (H <sub>2</sub> S)	2 pounds	500 pounds	7783-06-4	CVX - 301

### **Weather Conditions:**

Wind Speed	8 MPH
Wind Direction	75° (E to W)
Precipitation	None
Temperature (F)	43°
Stability Class	E

### **On Site Emergency Response:**

- Chevron Fire Department was notified approximately 05:20 AM.
- Plant Operators activated deluge system in the Crude Unit and applied water from fixed ground fire water monitors.
- Chevron Fire Department personnel arrived on scene at approximately 05:22 AM; ultimately 2 ladder trucks, 3 engine pumper trucks, and one Refinery emergency response unit applied approximately 6,000 GPM of fire water from mobile mounted high volume fire water monitors. An additional 2,000 GPM was being applied using fire water attack hoses. An estimated 2500 gallons of 1% foam concentrate was applied to the fire. The fire water demand rate dropped off significantly after approximately 07:00 AM.
- Responding organizations included Chevron Fire Department, Chevron Fire Brigade members and Richmond and El Cerrito Fire Departments. Petro-Chemical mutual aid was provided by Valero, Shell, Tesoro and Dow.
- A total of five (5) alarms were dispatched in response to this event and the Community Warning System was activated at Level 3.

**Off-Site Emergency Response:** Four (4) Chevron employees were immediately deployed outside of the refinery to manually take air monitoring samples at various locations downwind of the fire using direct-reading instrumentation. The manual monitoring continued throughout the incident.

**On-Site Impact:** Non-essential personnel were evacuated from the D&R area then sheltered-in-place. A Refinery-wide and Chevron Energy Technology Center shelter in place also occurred. One employee was treated for minor burns by the Chevron Fire Department and an outside hospital. That employee was released to return to work on the same day. Another employee received on-site treatment for a minor skin irritation and returned to work on the same day.

**Off-Site Impact:**

1. The Richmond Refinery activated a Level 2 and Level 3 notifications via the Contra Costa County Community Warning System.
2. On the day of the incident, Chevron received eleven (11) calls from the public.
3. Fence line monitoring:

The Refinery utilized the BAAQMD required continuous monitoring data from instrumentation located at the Refinery's High Hill, Office Hill and Gertrude Street monitoring stations. Data points are given close to or prior to the incident as a reference. The following maximum readings were recorded between the times the fire started and the time all-clear was called by CCHS. All readings were well below: (1) Reportable release thresholds, (2) Cal/OSHA's Permissible Exposure Limits (PELs) and (3) California OEHHA/ARB chronic inhalation Reference Exposure Levels (RELs). Therefore, emissions from the incident were well under both worker and community health exposure limits.

	High Hill	Office Hill	Gertrude Street	OSHA 8 hour limit (PEL)	Chronic REL
H2S	4 ppb @ 05:18	2 ppb @ 05:18	1 ppb @ 05:18	10,000 ppb	400 ppb
H2S	56 ppb @ 06:39	3.5 ppb @ 07:30	2 ppb @ 07:37	10,000 ppb	400 ppb
SO <sub>2</sub>	Station does not monitor	Non-detectable - <1 ppb	Non-detectable - <1 ppb	2,000 ppb	4 ppb

Note: The Cal/OSHA 8 hour PEL for SO<sub>2</sub> is 2,000 ppb (2 ppm) averaged over an 8-hour period. The Cal/OSHA PEL for H<sub>2</sub>S is 10,000 ppb (10 ppm) averaged over an 8-hour period.

**Sampling data and community monitoring results:**

All air samples taken during the incident indicate there was no evidence of adverse air quality, and hence, we would not expect adverse health impacts to have resulted from the incident. All sulfur and VOC compound analytical results were below: (1) Reportable release thresholds, (2) Cal/OSHA's Permissible Exposure Limits (PELs)<sup>1</sup>, and (3) California OEHHA/ARB chronic inhalation Reference Exposure Levels (RELs)<sup>2</sup>. Therefore, emissions from the incident were well under both worker and community health exposure limits.

All 31 direct-reading samples showed non-detectable concentrations of Hydrogen Sulfide (H<sub>2</sub>S), < 0.1 ppm. Sulfur Dioxide (SO<sub>2</sub>), < 0.1 ppm, and benzene < 0.1 ppm.

In addition to the direct reading instrument monitoring, Chevron personnel used Tedlar bags to gather a total of 11 air samples downwind of the refinery on the day of the fire. These samples were analyzed for sulfur and VOC compounds, the results are summarized below:

Testing for sulfur was performed using ASTMD-5504 method testing for 20 sulfur compounds. Only one compound, Carbonyl Sulfide was found above the detection limit<sup>2</sup>. The lab indicated interference from the Tedlar bags may contribute, in whole or in part, to the positive results of Carbonyl Sulfide. Testing for Volatile Organic Compounds (VOCs) was performed using EPA method TO-14A GC/MS Full Scan for 62 VOC compounds. Only five (5) compounds were detected above the detection limits.

**NOTES:**

<sup>1</sup> OSHA sets enforceable permissible exposure limits (PELs) to protect workers against the health effects of exposure to hazardous substances. PELs are regulatory limits on the amount or concentration of a substance in the air.

<sup>2</sup> The California Office of Environmental Health Hazard Assessment (OEHHA) Chronic Reference Exposure Limits (RELs) set airborne levels that would pose no significant health risk to individuals exposed continuously to that level. These limits are set to protect people living in communities surrounding such releases.

**CCHS Monitoring:**

In addition to the sampling and monitoring conducted by Chevron, CCHS gathered 3 ambient air samples during the incident and had them analyzed for VOCs. All results were characterized as at or near typical background levels.

**Agencies Notified, including time of Notifications:**

Primary: Community Warning System (CWS):

- a. Level 2 activated by the Richmond Refinery at 05:22 hrs
- b. Level 3, sirens activated by the Richmond Refinery at 05:30 hrs
- c. All-clear issued by CCHS via CWS at 08:40 hrs

Secondary: Additional notifications via telephone to the agencies below and others

The list below does not include all representatives from the respective agencies:

Cal/OSHA Inspector	Mr. Tom Johnston	(925) 348-3163
RPD Chief	Mr. Chris Magnus	(510) 323-3306
RFD Chief	Mr. Michael Banks	(510) 307-8041
CCHS HazMat Pgm. Asst. Director	Mr. Steve Morioka	(925) 646-2286
ECFD Chief	Mr. Maples	(510) 215-5540
BAAQMD Engr.	Mr. Bill Hammell	(510) 749-4605

<sup>2</sup> The detection limit refers to the minimum level which the testing instrument is capable of reading.

**Process Description:**

The Crude Unit distills crude oil to produce up to 9 distillate streams and vacuum resid.

Basically, the crude oil is heated, desalted and split into various product streams that are sent to intermediate tankage or to downstream processing units as feed.

The Crude Unit consists of the following systems:

- Crude Feed Booster Pumps
- Primary Heat Exchanger Train
- Desalter
- Flash Drum
- Secondary Heat Exchanger Train
- Atmospheric Furnace and Column
- Naphtha Stabilizer Column
- Vacuum Furnace and Column
- Product pumping and cooling
- Vent Gas Recovery
- Sour Water

The Crude Unit receives crude oil from off-plot tankage via booster pumps or via gravity feed.

**Appendix I – Simplified Drawing of Pump & Piping**

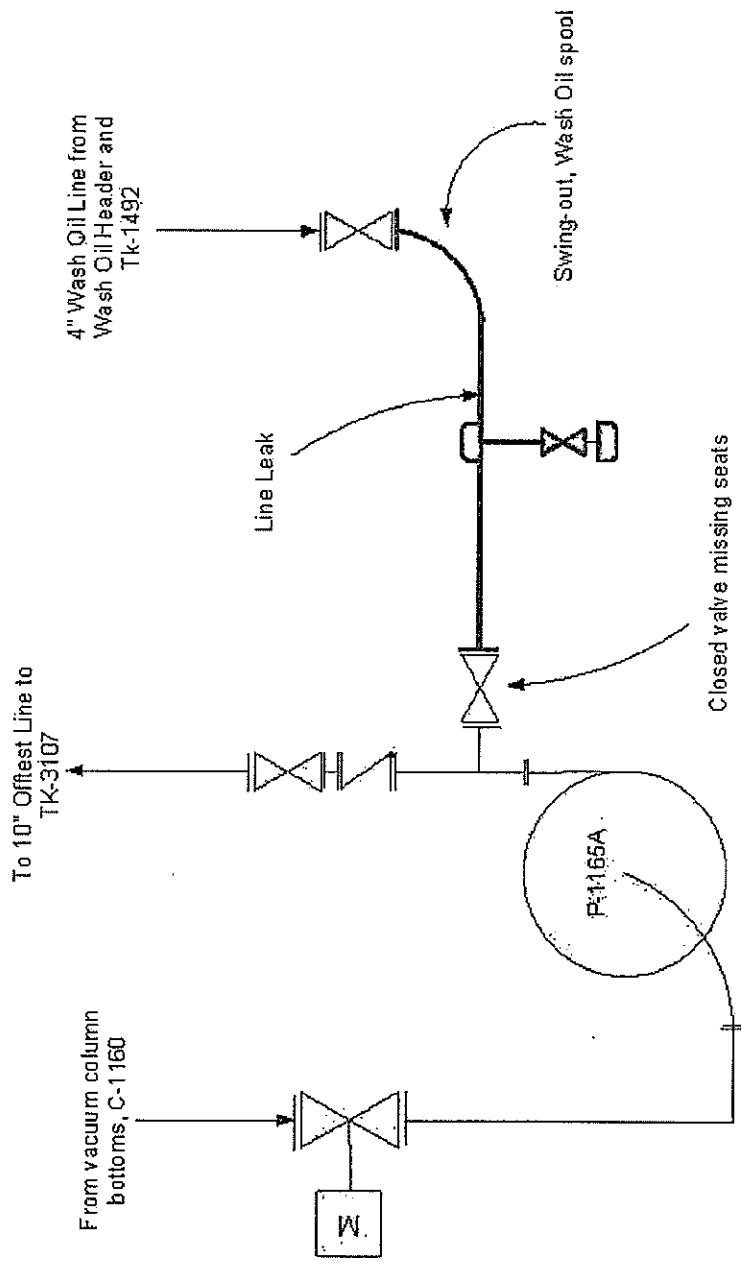
**Report approval:**

*Terry L. Garay*

Manager, Health, Environmental and Safety

**Simplified Drawing of Vacuum Column Bottom Pump  
P-1165A and Piping**

**Appendix I**



### **Description of What Occurred**

The refinery crude unit was being prepared for scheduled maintenance. As pump P-1165A was started, a release occurred from a swing out wash oil pipe spool when a section of that spool failed. The material released was a mixture of wash oil<sup>1</sup>, and partially processed crude oil. Within several seconds, at 05:18 AM, the mixture ignited resulting in first aid burns to an operator. Due to the fire's potential off-site impact, Chevron initiated a Contra Costa Health Services (CCHS) Community Warning System (CWS) Level 2 notification at 05:22 AM. Shortly thereafter, at 05:30 AM, a CWS Level 3 was issued to portions of the community alerting people to shelter in place. The main fire was extinguished at 07:00 AM and CCHS announced the CWS all clear at 8:40 AM. For safety reasons (to not accumulate quantities of unburned vapor) several small fires were allowed to continue in a controlled manner until 14:14 PM on the same day.

### **Investigation Team**

The investigation was facilitated by a Chevron Corporate Fire and Process Safety Engineer and led by Chevron Pascagoula Refinery Area Business Leader. Other core team member positions included a Chevron Pascagoula Refinery Designs Team Leader and the following from the Richmond Refinery: a plant Operating Assistant, two Head Operators, who are also United Steel Worker Union Health and Safety Representatives, and a Corporate Crude Unit subject matter expert. Additional experts were involved in the analysis of the incident and the investigation on an as needed basis.

### **Investigation Methodology**

The team followed a proprietary root cause analysis methodology, TapRooT®, developed by System Improvements, Inc. of Knoxville TN. The TapRooT® investigation process requires the systematic evaluation of each causal factor against a structured hierarchy, called the Root Cause Tree®. The Root Cause Tree consists of a series of questions relating to individual performance, team performance and management systems that lead to a set of Basic Cause Categories. Within each Basic Cause Category are a number of unique root causes, as defined by Systems Improvement, Inc.

### **Causes**

Primary Cause: Per original plant design the pipe spool for connecting wash oil to the discharge of the pump is a swing out type, which was not intended to be connected to the pump discharge line during normal operation. Instead, the spool was connected to the discharge of the pump for an extended period of time. Leaving the swing out wash oil pipe spool connected to the discharge of the pump allowed the spool to be exposed to process conditions. Metallurgical testing and analysis indicate that the failed section of the spool was thinned by high temperature sulfidation corrosion.

Contributing Cause: The gate valve off P-1165A discharge line was missing its valve seats. The pump startup allowed full pump discharge pressure to enter and rupture the thinned section of the spool. While modeling did not show that the missing seats alone caused corrosion to occur, the missing seats are believed to have contributed to process conditions that allowed sulfidation corrosion and thinning of the spool to occur.

<sup>1</sup> Wash oil is basically diesel fuel that is used to remove heavier crude oil residue from the internals of equipment in preparation for equipment clean-up and maintenance.

**Root Causes (as defined in the Tap Root® methodology) & Corrective Actions:**

Causal Factor No. 1: Swing out wash oil spool connected to the discharge of pump P-1165A was connected for a lengthy period of time (20+ years).

Background: Swing out wash oil spool was left connected to plant pipe without going through a thorough evaluation utilizing a formal Management of Change process prior to updating plant Piping and Instrumentation Diagrams (P&IDs).

Root Cause: Management System –Standards, Policies or Administrative Controls (SPAC) Confusing or Incomplete.

Note: Confusing or incomplete infers the existing SPAC (procedures), used at that time, did not fully address/specify what actions/steps were needed at the time changes to this equipment configuration took place.

**Corrective Actions & Status:**

1. Determine the integrity of the swing out wash oil spools at all hot oil pumps in the Crude Unit and repair or replace as necessary. Utilizing the MOC process, change the design for permanent installation of the spools or implement operating procedures to ensure those spools at all hot oil pumps in the Crude Unit are disconnected or blinded at the first block valve off the pump during normal unit operation. Ensure the plant P&IDs reflect this design.  
Richmond implemented the Inherently Safer Solution: Upgraded wash oil pipe spool metallurgy/design in the Crude Unit for permanent installation, eliminating the potential for sulfidation corrosion.  
Status: Complete
2. It is believed that the change in operation of the spool occurred before the Refinery instituted a more rigorous Management of Change (MOC) process in 1993 to ensure that changes (other than in-kind) are evaluated and approved prior to implementation of such changes in the field. The MOC process would have identified the implications of the technical and health and safety impacts of this type of change.  
Status: Complete.
3. Reinforce that field conditions which are found that do not match existing P&IDs use the MOC process to verify P&ID changes are fully evaluated prior to changing such documentation.  
Status: Complete
4. Send communication to Chevron Global Refining Operations and Reliability Managers to evaluate metallurgical specification breaks at all hot oil (>475 °F) pumps, with emphasis on positive isolation at specification break points.  
Estimated Completion Date: 5/31/07
5. Identify (refinery wide) existing swing out spools and verify they are still being operated as such, or ensure a proper design review has been conducted for changed operation.  
Estimated Completion Date: 5/31/07

Causal Factor No. 2: Seats missing in the 4-inch 5 Chrome gate valve at the wash oil connection point off of the discharge of P-1165A.

Background: The Richmond Refinery was not able to determine if the valve was received from the manufacturer with missing seats, or if repairs were made to the valve and the seats were not reinstalled.

Root Cause: Manufacturing or Quality Control: Unable to Determine.

Note: The TapRooT® process specifies “unable to determine” if the root cause is not conclusive. Below, Chevron has identified corrective actions that would prevent a recurrence if the basic cause was either manufacturing or quality control related.

Corrective Actions & Status:

1. Replace the valve on P-1165A discharge piping to wash oil pipe spool.  
Status: Complete.
2. Chevron Global Procurement to ensure contract language requires valve suppliers to administer quality control checks for proper assembly of new valves and that procedures include a seat tightness hydrotest for all existing valves undergoing repairs by third party valve repair shops. This applies to existing and new contracts.  
Estimated Completion Date: 01/31/08
3. Richmond Refinery Machine Shop to ensure their procedure includes a seat tightness hydrotest for all valves undergoing trim modifications or repairs by the Refinery machine shop.  
Estimated Completion Date: 05/31/07
4. Communicate the recommendation that all Chevron Refining machine shops ensure procedures include a seat tightness hydrotest for all valves undergoing trim modifications or repairs by the Refinery machine shops.  
Estimated Completion Date: 7/31/07

## Additional Information that Demonstrates Regulatory Compliance

**Date & Time Event Began:** Monday, January 15, 2007, 05:18AM

**Date & Time Safe and Controlled Conditions Were Established:** Fire under control and CCHS Community Warning System all clear sounded at 08:40AM, January 15, 2007 (controlled burning of several small leaks remained to prevent accumulation of flammable vapors). All fires extinguished January 15, 2007, 14:14PM

**Date & Time Investigation Started:** January 15, 2007, 07:00AM.

**Type of Incident:** CWS Level 3

**Cost of Incident:** Greater than \$500,000

**Chemicals released:** The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Emergency Planning and Community Right-To-Know Act (EPCRA) require reporting when a facility releases more than a "reportable quantity" of a hazardous substance. The reportable release thresholds are based upon EPCRA & CERCLA reporting requirements. No materials released exceeded these reporting thresholds. Final calculations of the total materials released are noted below, which are a result of the materials combusted during the fire:

Material Released	Quantity Released	Reportable Release Thresholds	CAS Number	MSDS Number
Sulfur Dioxide (SO <sub>2</sub> )	377 pounds	500 pounds	7446-09-5	CVX - 584
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Hydrogen Sulfide (H <sub>2</sub> S)	2 pounds	500 pounds	7783-06-4	CVX - 301

### **Weather Conditions:**

Wind Speed	8 MPH
Wind Direction	75° (E to W)
Precipitation	None
Temperature (F)	43°
Stability Class	E

### **On Site Emergency Response:**

- Chevron Fire Department was notified approximately 05:20 AM.
- Plant Operators activated deluge system in the Crude Unit and applied water from fixed ground fire water monitors.
- Chevron Fire Department personnel arrived on scene at approximately 05:22 AM; ultimately 2 ladder trucks, 3 engine pumper trucks, and one Refinery emergency response unit applied approximately 6,000 GPM of fire water from mobile mounted high volume fire water monitors. An additional 2,000 GPM was being applied using fire water attack hoses. An estimated 2500 gallons of 1% foam concentrate was applied to the fire. The fire water demand rate dropped off significantly after approximately 07:00 AM.
- Responding organizations included Chevron Fire Department, Chevron Fire Brigade members and Richmond and El Cerrito Fire Departments. Petro-Chemical mutual aid was provided by Valero, Shell, Tesoro and Dow.
- A total of five (5) alarms were dispatched in response to this event and the Community Warning System was activated at Level 3.

**Off-Site Emergency Response:** Four (4) Chevron employees were immediately deployed outside of the refinery to manually take air monitoring samples at various locations downwind of the fire using direct-reading instrumentation. The manual monitoring continued throughout the incident.

**On-Site Impact:** Non-essential personnel were evacuated from the D&R area then sheltered-in-place. A Refinery-wide and Chevron Energy Technology Center shelter in place also occurred. One employee was treated for minor burns by the Chevron Fire Department and an outside hospital. That employee was released to return to work on the same day. Another employee received on-site treatment for a minor skin irritation and returned to work on the same day.

**Off-Site Impact:**

1. The Richmond Refinery activated a Level 2 and Level 3 notifications via the Contra Costa County Community Warning System.
2. On the day of the incident, Chevron received eleven (11) calls from the public.
3. Fence line monitoring:

The Refinery utilized the BAAQMD required continuous monitoring data from instrumentation located at the Refinery's High Hill, Office Hill and Gertrude Street monitoring stations. Data points are given close to or prior to the incident as a reference. The following maximum readings were recorded between the times the fire started and the time all-clear was called by CCHS. All readings were well below: (1) Reportable release thresholds, (2) Cal/OSHA's Permissible Exposure Limits (PELs) and (3) California OEHHA/ARB chronic inhalation Reference Exposure Levels (RELs). Therefore, emissions from the incident were well under both worker and community health exposure limits.

	High Hill	Office Hill	Gertrude Street	OSHA 8 hour limit (PEL)	Chronic REL
H2S	4 ppb @ 05:18	2 ppb @ 05:18	1 ppb @ 05:18	10,000 ppb	400 ppb
H2S	56 ppb @ 06:39	3.5 ppb @ 07:30	2 ppb @ 07:37	10,000 ppb	400 ppb
S02	Station does not monitor	Non-detectable - <1 ppb	Non-detectable - <1 ppb	2,000 ppb	4 ppb

Note: The Cal/OSHA 8 hour PEL for SO<sub>2</sub> is 2,000 ppb (2 ppm) averaged over an 8-hour period. The Cal/OSHA PEL for H<sub>2</sub>S is 10,000 ppb (10 ppm) averaged over an 8-hour period.

**Sampling data and community monitoring results:**

All air samples taken during the incident indicate there was no evidence of adverse air quality, and hence, we would not expect adverse health impacts to have resulted from the incident. All sulfur and VOC compound analytical results were below: (1) Reportable release thresholds, (2) Cal/OSHA's Permissible Exposure Limits (PELs)<sup>1</sup>, and (3) California OEHHA/ARB chronic inhalation Reference Exposure Levels (RELs)<sup>2</sup>. Therefore, emissions from the incident were well under both worker and community health exposure limits.

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**NOTES:**

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**CCHS Monitoring:**

In addition to the sampling and monitoring conducted by Chevron, CCHS gathered 3 ambient air samples during the incident and had them analyzed for VOCs. All results were characterized as at or near typical background levels.

**Agencies Notified, including time of Notifications:**

Primary: Community Warning System (CWS):

- a. Level 2 activated by the Richmond Refinery at 05:22 hrs
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BAAQMD Engr.	Mr. Bill Hammell	(510) 749-4605

<sup>2</sup> The detection limit refers to the minimum level which the testing instrument is capable of reading.

**Process Description:**

The Crude Unit distills crude oil to produce up to 9 distillate streams and vacuum resid. Basically, the crude oil is heated, desalts and split into various product streams that are sent to intermediate tankage or to downstream processing units as feed.

The Crude Unit consists of the following systems:

- Crude Feed Booster Pumps
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- Atmospheric Furnace and Column
- Naphtha Stabilizer Column
- Vacuum Furnace and Column
- Product pumping and cooling
- Vent Gas Recovery
- Sour Water

The Crude Unit receives crude oil from off-plot tankage via booster pumps or via gravity feed.

**Appendix I – Simplified Drawing of Pump & Piping**

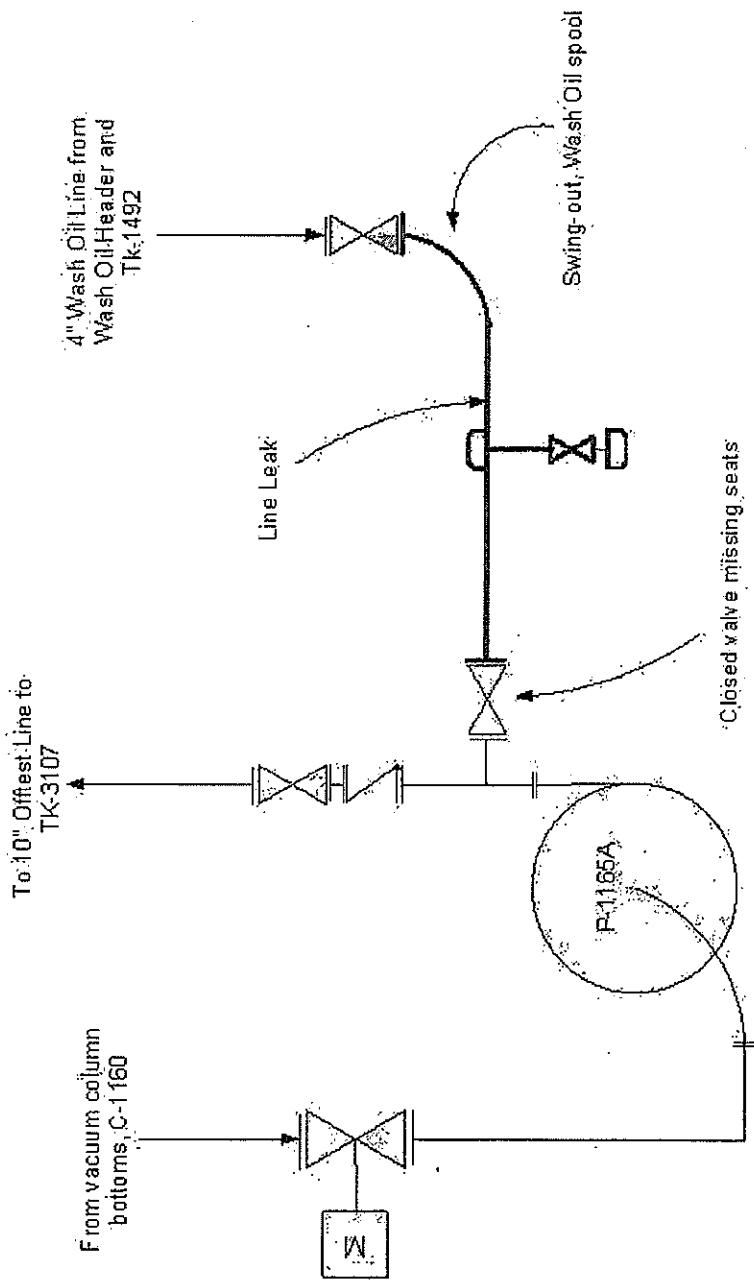
**Report approval:**

*Terry Lyman*

Manager, Health, Environmental and Safety

**Simplified Drawing of Vacuum Column Bottom Pump  
P-1165A and Piping**

**Appendix I**





# Investigation Summary Report

ITS 2007-008

Richmond Refinery

Special Instructions

MITS Incident # **MITS-2007-1126**Status **Complete****Incident/Event Information**

Event Date	<b>Monday, January 15, 2007</b>		Reporting Company	<b>CHEVRON PRODUCTS COMPANY</b>	
Event Time	24 Hr.	<b>0518</b>	Standard	<b>5:18 AM</b>	
Event End Date	<b>Monday, January 15, 2007</b>		Facility	<b>Richmond Refinery</b>	
Event End Time	24 Hr.	<b>1723</b>	Standard	<b>5:23 PM</b>	
Mgmt Sponsor	<b>Carl Simmers</b>			Reporting Area	<b>D&amp;R ABU</b>
Incident Type	<b>Process</b>			Section	<b>D&amp;R General</b>
Maintenance Focus	<b>Reliability</b>			Crew/Group	
Affected Equipment	<b>Rotating</b>		Locations Impacted	<b>#4 Crude</b>	
			Impacted Plant	<b>#4 Crude</b>	

When did you find out about the event?

Time **5:20 AM**Date **Monday, January 15, 2007**Event Title **Fire at #4 Crude Unit - CWS Level 3 Event (101764)**

Description

This investigation is being conducted under attorney-client privilege.  
 For more information contact the Refinery Incident Coordinator: Mike Baer at 242-3567.

Event Classification

Near Miss:  Yes  NoPSM Near Miss:  Yes  NoMCAR Near Miss:  Yes  No

Category

**REPUTATION**

NSR Consent Decree

 Yes  NoLevel **Level 3b**

Type

**Incidents reportable to outside agencies and requiring or threatening shut down of operations**

# PHA Findings



[PHA Database](#) | [PSM Home](#) | [LC, Seismic & ISS Findings](#)

| [PHA Search](#) | [PHA Results](#) | [Employee Feedback](#) | [Print this page](#) |

ABU	Plant	Revalidation	Start Date	End Date	Facilitator
D&R	#4 Crude Unit	2nd Revalidation	9/3/2005	9/13/2005	Wayne Howard - AcuTech

## Team Members / Role

Lowell King - Operations, Larry Cawthon - Operations, Ron Post - Designs Engineering, Zim Zarbis & Garth Jolly, Process Engineering

## Additional Comments / Name

The #4 Crude Unit & D&R Flare PHA revalidations were performed back-to-back and with the same team members. Refer to D&R Flare 2nd Revalidation findings for concerns and resolution plan

- \* Further discussion about any portion of the report and its contents should be directed to the facilitator or any of the team members listed

## Reviewed By      Date      Feedback/Comments

Reviewed By	Date	Feedback/Comments
Other Individual	11/21/2005	mtbr

## Section No      Section Description

1 Crude Feed and Startup/Shutdown Piping, Including P-1101A, B, C to intels of E-1101A-D, and Auxiliary Piping.

Item	Deviation	SOE RR	Resolution
16	Human Factors The concern is there is a need for additional training on RMPC/T and DQ <sup>2</sup> in regards to control strategy for operating the crude unit. Consider providing additional training on these control systems.	O	<p>5 1) Jim Zarbis - coordinate installation of training simulators. Zarbis, 10/24/2006 Completed            2) Ken Walker - develop training material for simulators. 3) James T. Fred Detmarse - develop logic tree diagram or other training aide to explain RMPC/T control moves</p>
	Contamination Concern: The new Agar probe and associated high water alarm are not reliable. Consider addressing this problem.	S	<p>3 1) By 9/1/06 Ken Walker - Work with Maintenance to set-up and implement a periodic PM to improve the reliability of Kenneth B. the Agar probe. 2) By 3/1/05 Garth Jolly to Determine</p>

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scope for 2006 s/d to consider a back-up means of determining high water content NOTE: Both tasks will need to be documented as completed prior to signing this action item off. (SLC uses radioactive gravity analyzer for the determination of high water content.)

Section No	Section Description						
101	Cooling Water.						
Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
5	Human Factors Concern is that staging must be built in order to provide backup CW for the E-1160, E-1161 and E-1162s. Consider installation of permanent platform or relocate the valves in a location that is easier to reach.	O 5	Ken Walker / Lowell King - field walk; find alternate block valves.	Walker, Kenneth B.		9/24/2006	Completed
				<i>Staging has been built.</i>			

Section No	Section Description						
112	Offtest Header						
Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
2	Human Factors Concern is that consequences described have previously occurred and could re-occur. Consider verifying that procedures are in place such that when crude feed tank switches occur, the offtest line is not lined up to the new crude feed tank. AND Consider commissioning a dedicated offtest tank.	O 4	Curry - confirm with T&B procedures to route 10" off test line to appropriate tank. Communicate findings to affected personnel. Dedicated off test tank - declined. Basis: Refinery has 7 tanks in crude service.	Curry, David P.		9/24/2006	Completed
				<i>Off test header to off test tank Procedures</i>			

Section No	Section Description						
120	"Wrap-up" Discussion of Issues General to the 4 CU Plant (Section 1-101).						
Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
6	Human Factors Concern is that Piping labeling in some areas of the 4 Crude Unit Plant remains poor, leading to possible human error and contamination of processes. Consider labeling the following: 1. All plot limit lines, both upper and lower decks. 2. Resid system. 3. VBCR system. 4. All exchangers in the crude unit (paint has faded). 5. Crude flow through primary and secondary train.	O 5	Lowell King - field walk; issue PP to label pipe systems as determined appropriate.	King, Lowell J.		9/24/2006	Completed
7	Human Factors Concern is the closure of this AC from the 1st revalidation still needs work. Consider volume control on the audible alarm (Control Engineer could activate during startup/shutdowns, etc.). Also consider expanding the low-priority cut-off during startups and shutdowns to lessen the	S 3	ABU presently installing software to ID nuisance alarms; Dave Curry - HO / PCO to review in PIT mtgs weekly the nuisance alarms; provide input to Control engineers to correct.	Curry, David P.		9/24/2006	Completed
				<i>Off test header to off test tank Procedures</i>			

number of alarms.

Section No	Section Description	Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
21	Desalter V-1102 and Auxiliary Piping. Includes Desalinated Crude to Flash Drum V-1103. Includes Antifoam System and Atmospheric Circulation Reflux From P-1148/A.	15	More Level	Concern is that the existing Drexelbrook probe still is not functioning properly and is contributing to poor desalter operation. Consider improving probe reliability.	O/L	O 3 Garth Jolly -determine 2006 s/d worklist scope.	Jolly, Garth	3/1/2006	Completed
23	Desalter effluent water into C-1180, through P-1180/A, E-1123A/B, and through E-1125 to DEBRU.								
Section No	Section Description	Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
18	More Pressure Concern is incomplete removal of HC/benzene from C-1180. Consider reducing pressure losses associated with PV-080 and piping to allow operation of C-1180 at lower pressures to increase flashing of light HCs.				O 4	C-1180 overhead system is presently restricted by a 2" section of piping near the inlet of destination vessel V-3211. W. This piping will be upsized to match the 4" inlet nozzle on V-3211.	Post, Ronald	3/1/2006	Completed
25	Desalter Water Tank V-1109 and Auxiliary Piping. Includes oil skim line to P-1198 and sour off-gas to vent gas recovery.				O 3	Ken Walker - Modify start-up procedures for routing V1160 to V1109 to prevent excess liquid build up.	Walker, Kenneth B.	9/24/2006	Completed
26	Hot Crude Recycle Line	1	No Flow	A/C	SOE RR	Resolution	Owner	Due By	Status
					O 5	Ken Walker - field walk to clarify concern in field. Larry Cawthorn - modify procedures to reflect additional valves. Larry - capture repair of block valves to 2006 s/d work list, as appropriate. Ensure both tasks have been completed prior to signing this off as complete	Walker, Kenneth B.	3/1/2006	Completed

**Section No**

32

**Section Description**

Atmospheric Column Furnaces F-1100A/B, Including BFW, Superheated Steam to C-1100, Superheated Steam to C-1140/C-1130 (C-1140 is out of service and daylighted).  
Also fuel gas system at the furnaces and the burner system as well as the fuel gas coalescer (K-1196).

<b>Item</b>	<b>Deviation</b>	<b>A/C</b>	<b>SOE RR</b>	<b>Resolution</b>	<b>Owner</b>	<b>Due By</b>	<b>Status</b>
14	No Flow /	Concern is that the ability to remotely activate smothering steam from the control board was never activated following completion of the FSC project. Consider finishing installation of the control board activation facilities.	S	5 Ed Burghardt - finish installation and test system for operation.	Burghardt, Edward L.	9/4/2006	Completed
21	Less Flow	Concern is that presence of water in fuel gas can still lead to plugging leading to furnace upsets and un-necessary work for maintenance personnel. Consider installing blowdown facilities to drain water from the low points of the fuel gas header.	O	5 Jim Zarbis / Ed Shepherd / Garth Jolly - determine 2006 s/d work list scope. Ken Walker - work with Operations to blow down header on a periodic basis. (Interim fix) Note: Both items need to be completed prior to signing this off as complete.	Zarbis, James T.	9/24/2006	Completed
42	Miscellaneous- Plant Operation 1160	Concern is harmonics associated with F-1100A/B and F-Plant Operation 1160 will lead to furnace incidents. Consider developing a plan to deal with harmonic oscillations on the furnace leading to Training and Procedures for operators.	S	5 Ed Shepherd - develop EOM info for Operators to use to correct situation.	Zarbis, James T.	9/24/2006	Completed

**Section No**

33

**Section Description**

Caustic injection from T-1104 through P-1104, to the inline mixer to F-1100A/B inlet line.

<b>Item</b>	<b>Deviation</b>	<b>A/C</b>	<b>SOE RR</b>	<b>Resolution</b>	<b>Owner</b>	<b>Due By</b>	<b>Status</b>
13	Concentration	Concern is that without knowing the exact concentration of caustic that is provided from EOD and injected into the secondary heat train, residual chlorides may still be present creating corrosion. Consider confirming the concentration associated with each caustic batch transfer. In addition, provide Training and Procedures to operations to effectively vary injection rates depending on caustic concentration.	S	5 Garth Jolly - research 2004 test run for spent caustic vs. chloride control. Issue PED Reco.	Jolly, Garth	5/1/2006	Completed

**Section No**

36

**Section Description**

#1 Sideduct from C-1110 through P-1119/P-1129A, through E1105A/B to the JHT as hotfeud or to E-1119 and then T-297 (Cold Jet Tankage).

<b>Item</b>	<b>Deviation</b>	<b>A/C</b>	<b>SOE RR</b>	<b>Resolution</b>	<b>Owner</b>	<b>Due By</b>	<b>Status</b>
11	Mis-Directed Flow, Human Factors	Concern is that line-ups to P-1129A suction and discharge are not clearly labeled in the field. This could result in the mis-manifolding of the pump. Consider properly labeling suction and discharge of P-1129A.	O	5 Lowell King - Issue Passport work request to fab and install labels. Labels to be installed by 9/24/06	King, Lowell	12/31/2005	Completed

Section No	Section Description						
38	#2 Sidecut Stripper Bottoms from C-1120 through P-1129/A, through E-1103 and E-1104 to JHT as hot feed or to E-1129 to cold Jet Tankage.						
14	Human Factors Concern that no formalized training and procedures are in place on how to drain oil from the sump of applicable pumps. Consider developing T/P on this subject.	OIL /	S 3	Mike Klein/James TRail - coordinate with Division Maintenance on implementing the Four Senses training.	Curry, David P.	10/1/2006	Completed

Section No	Section Description							
39/40	Vacuum Bottom Circulating Reflux From P-1188/A to FV-020A, through E-1116A-F and E-1188. Includes 8 s/c pumpback from P-1188/A through K-1181A/B and K-1182A/B to C-1160. Also includes emergency quench from 7 s/c to 8 s/c pumpback via HV-087. This system provides 8 s/c product to P-1188/A (covered in section 41).							
24	Less Temperature required for the tubes. Consider evaluating whether operation should be with one or two banks of the E-1116s.	OIL /	O/C	0 5 Ron Post / Garth Jolly - Issue findings on velocity study to Operations. The E-1116 HX's are arranged in two parallel banks of three units each. It is likely that use of both banks does create lower than optimum flow thru tubeside. However use of one bank does not allow Crude Unit to feed desired rates. Low tubeside velocities MAY create an environment more prone to plugging however this should not be associated to increased risk to people. Four of these bundles were recently replaced with SS bundles which are expected reduce fouling tendencies.	Post, Ronald W.	12/31/2005	Completed	
42/43	#3 Sidecut from C-1100 to C-1130 then through P-1139/P-1149A and E-1112, then to the DHU or through E-1139 and to washoil tankage. Includes E-1137A/B.	OIL /	A/C	SOE RR	Resolution	Owner	Due By	Status
1	No Flow	OIL	O/C	O 5 Declined: An APS system on a shared spare pump is a safety issue as piping manifold alignment changes (3s/c service, 4 s/c service).	Zarbis, James T.	9/30/2006	Declined	
8	Less Flow	OIL	O/C	O 4 Dave Curry - capture new separate pump installation for a planned s/d following the 2006 s/d. (this is a long lead item due to electrical system limitations in the ABU)	Curry, David P.	9/24/2006	Completed	

Section No	Section Description						
57	Steam drum V-1177 and auxiliary piping.						
11	Startup/ Concern that the temporary blowdown piping on the suction line will be removed after startup.	OIL	S 3	Ron Post / Larry Cawthorn - conduct a field walk; For 2006 Post, Ronald 4/1/2006 Completed			

Right side of concern about piping being removed after startup.

Shutdown line to P-1177A is installed differently each shut down and design is inadequate. Hot condensate is directed towards operating personnel, system is difficult to operate, and noise level is very high. Large vapor cloud is created and visibility is reduced. Potential for employee/contractor injury is very high. Consider designing permanent system to route to steam/condensate to location further away from unit to mitigate the risks. Another option is to route to an existing condensate recovery system.

s/d; install hard pipe that routes away from operating areas, to remote area. Find other locations for future s/d's w.

Section No	Section Description	Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
63	C-1160 overhead vapors from K-1160's to and through E-1160/A/B.	3	No Flow	Concern is that the spare pump P-526A is smaller than the primary pump. A potential for a LPO exists. Consider increasing the size of the spare pump (steam operated).	O	Declined; 2006 s/d work list items address VTCR C-1160 exchanger repairs. Once the repairs are complete, demand for CW will decrease, consequence of using smaller pump will decrease.	Zarbis, James T.	9/30/2006 Declined	
68	V-1160 oil through P-1160/A to crude feed.	3	No Flow	Concern is that there are modes of operation where two pump operation is required for extended periods. Loss of one pump can lead to issues described in consequence section. Consider evaluating options to either reduce flows so that single pump operation is possible OR increase the sizing of the pumps (P-1160/A)	E	Declined; 2006 s/d work list items address C1160 repairs. Once the repairs are complete, stop oil production will decline	Zarbis, James T.	10/26/2006 Declined	

Section No	Section Description	Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
68	V-1160 oil through P-1160/A to crude feed.	3	No Flow	Concern is that there are modes of operation where two pump operation is required for extended periods. Loss of one pump can lead to issues described in consequence section. Consider evaluating options to either reduce flows so that single pump operation is possible OR increase the sizing of the pumps (P-1160/A)	E	Declined; 2006 s/d work list items address C1160 repairs. Once the repairs are complete, stop oil production will decline	Zarbis, James T.	10/26/2006 Declined	
71	C-1160 vacuum column bottoms through P-1165/A, K-1165/A/B, E-1165/A/B and E-1110/A/B to inlet of E-1163/A/B.	18	/ Startup/ Shutdown	Concern is that the LOTO procedure does not address equipment that may solidify if allowed to cool. Consider modifying Richmond LOTO procedure to ensure learnings from ES Incident are incorporated.	S	Ken Walker - Verify procedures are in place to ensure steam tracing is in service. Carl Simmers - contact ES to see if any findings can be shared.	Walker, Kenneth B.	9/24/2006 Completed	

Section No	Section Description	Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
71	C-1160 vacuum column bottoms through P-1165/A, K-1165/A/B, E-1165/A/B and E-1110/A/B to inlet of E-1163/A/B.	18	/ Startup/ Shutdown	Concern is that the LOTO procedure does not address equipment that may solidify if allowed to cool. Consider modifying Richmond LOTO procedure to ensure learnings from ES Incident are incorporated.	S	Ken Walker - Verify procedures are in place to ensure steam tracing is in service. Carl Simmers - contact ES to see if any findings can be shared.	Walker, Kenneth B.	9/24/2006 Completed	
19	Miscellaneous		Safety	Concern is that the P-1165's do not have suction EBV's. Although the P-1165's have suction MOV's, they do not automatically shut down the pumps. EBV's would provide positive isolation on the system. In the event of a fire or	S	Complete EBV installation on the P-1165/A suction during the upcoming shutdown as C-1160 will be out of service and chemically cleaned. A/C still open. Ron Post - capture item on 2006 s/d work list. (complete) EBV's are on site	Post, Ronald W.	9/1/2006 Completed	

OK / 30/06  
OK / 30/06  
OK / 30/06  
OK / 30/06

leak (example: 2000 incident on leak of P-1165 warm-up line), there would be no positive isolation on C-1160 and the large amount of fuel it could potentially provide. The Chevron Fire protection manual recommends: Installation of EBV's on systems where a seal failure could result in a hydrocarbon release, the release could ignite from the hot metal surfaces of the failed seal, or from other nearby sources of ignition. It recommends if the pump is fed from a vessel containing 2,500 gallons of stock or handles stock above 600 deg., or if the hydrocarbon liquid is of a volatile stock or above auto-ignition point, EBV's should be installed. If the pump handles flammable liquids, or the liquid is above its flash point in a congested area EBV's should be installed. During the 1998 turnaround we installed the EBV's on P-1188/A, P-1105/A, P-1128/A and P-1190/A. P-1165/A had EBV's installed on the seal flush but we were unable to complete the installation of the suction EBV's due to piping size modifications required for installation. Consider completion of the EBV installation on the P-1165/A suction during the upcoming shutdown as C-1160 will be out of service and chemically cleaned. A/C still open.

Concern is that the APS system on P-1165/A still does not work at this time. Consider redesigning APS system on P-1165/A.

and scheduled to be installed during upcoming 1Q/06 D&R S/D

#### Section No

#### Section Description

75 Resid from the outlet of the E-1110's to E-1163's through FV-065 (LV-061) to the plot limit.

Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
10	Miscellaneous	Concern is that rates must be reduced periodically due to high pressure drops through the exchangers (E-1162A/B, E-1110 A/B) and control valve (LV-061/FV-065). Consider performing an evaluation of the pressure drop losses in equipment and modify piping to rectify if possible.	O ✓	O 4 Complete. Currently have procedure to predict resid yields based on crude throughput. ABU satisfied this addresses a/c.	Zarbis, James T.	9/24/2006	Completed

#### Section No

#### Section Description

#7 Sidecut from C-1160 through P-1179/P-1189A to RLOP/TKN. 7 s/c also provides seal flush to heavy oil pumps and emergency quench to 8 s/c pumpback.

Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
10	Less Flow	Concern is the current pump (P-1179) had a new impeller installed (MOC# 12604) which may be able to overpressure E-1109 or other downstream equipment under blocked in conditions. Consider verifying if the deadhead pressure of the pump can exceed the design pressure of the	O ✓	S 5 Ron Post - perform designs engineering study; issue findings and recommendation. Change needs to be implemented by 10/24/06 unless the change requires a planned shutdown to implement.	Post, Ronald W.	9/24/2006	Completed

downstream equipment.

Section No	Section Description						
91	P-1171B through P-1171/A to P-1198 suction. Includes V-1171 bottoms through P-1171/A.						
Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
8	More level addition, there is no spare pump available for this service. Consider modifying P-1171 to start automatically on high level in V-1170 as well as shutdown on low level.	Concern is that P-1171B must be manually started. In addition, there is no spare pump available for this service. Consider modifying P-1171 to start automatically on high level in V-1170 as well as shutdown on low level.	S 5	Dave Curry - reinforce training on use of pump in manual mode. (interim fix) Ed Burghardt - install local s/d device with input from level instrumentation. Note: Both items need to be completed prior to signing this off as complete.	Burghardt, Edward L.	9/24/2006	Completed

Section No	Section Description						
92/94/97	Vent gas from V-1171 through K-1171/A first stage, through vent gas recovery interstage cooler, E-1172/A.						
Item	Deviation	A/C	SOE RR	Resolution	Owner	Due By	Status
19	Human Factors	Concern that operations has expressed a desire for guidelines/procedures on operation of the K-1171/A and K-3950 compressors. Consider providing guidance on managing both column pressure and relief header pressures with the existing compressors.	E 4	Bruce Smith - 2007 s/d will commission K2+2 in relief service; with result of K1171 removed from relief service.	Zarbis, James T.	9/24/2006	Completed

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## LC, Seismic & ISS Findings

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### Latent Condition Finding

Area	D&R	Plant	#4 CRUDE UNIT
Review Date	4/24/2006 9:42:19 AM	Owner	Tydingco, James D.
Due By	9/1/2006	Status	Completed

#### LC Number & Question

(4-3) Is the communication capability between operators, and between operators and the control room or other necessary locations adequate during normal operations and emergencies?

#### Concern

During emergency situations the radio system can be overloaded and operation becomes intermittent. Phones, e-mail and the computer system are normally OK.

#### Recommendation

Determine whether we have done any recent test of the communication systems during emergencies and were there were findings that support this statement. If so, identify the actions and resolution plans and due dates to close the issues which are presented above?

#### Action Taken

The resolution to this reco will be covered under RIOS ID 462 under 4 Rheniformer due to the same issues being addressed under that reco.

### Latent Condition Finding

Area	D&R	Plant	#4 CRUDE UNIT
Review Date	4/19/2006 11:56:04 AM	Owner	Curry, David P.
Due By	11/1/2006	Status	Completed

#### LC Number & Question

(3-50) Does the level of automation allow sufficient operator involvement so operators do not feel detached from the process, particularly during emergency situations where they must assume manual control?

<b>Concern</b>	Include opportunity to run plant in unoptimized automatic control mode on plant simulator being developed by Process Control group to allow operator practice on emergency scenarios.
<b>Recommendation</b>	Develop plan to have qualified #4 Crude Unit board operators gain access to and use the training simulator in the unoptimized control mode.
<b>Action Taken</b>	A letter has been written in the Area Supervisor notes which allows Head Operators at their discretion to take RMPCT out of service for operator training at any time. Also a Simulator is being placed in the control house for operators to practice emergency scenarios.

<b>Latent Condition Finding</b>		Plant	#4 CRUDE UNIT
<b>Area</b>	D&R	Owner	Tydingco, James D.
<b>Review Date</b>	4/19/2006 10:43:26 AM	Status	Completed
<b>Due By</b>	9/1/2006		
<b>LC Number &amp; Question</b>			
(4-1) Are the communications facilities between process units adequate for clear and uninterrupted communications during both normal and emergency situations (e.g., telephone land lines, radio, computer network, and E-mail, and are systems redundant and/or secure?			
<b>Concern</b>			
During emergency situations the radio system can be overloaded and operation becomes intermittent. Phones are normally OK.			
<b>Recommendation</b>			
Determine whether we have done any recent test of the communication systems during emergencies and were there were findings that support this statement? If so, identify the actions and resolution plans and due dates to close the issues which are presented above?			
<b>Action Taken</b>			
This reco will be addressed under RISO IS 462.4 then due to that reco addressing the same issues.			

<b>Latent Condition Finding</b>		Plant	#4 CRUDE UNIT
<b>Area</b>	D&R	Owner	Curry, David P.
<b>Review Date</b>	4/19/2006 10:22:31 AM	Status	Completed
<b>Due By</b>	8/1/2006		
<b>LC Number &amp; Question</b>			
(4-2) Is communications equipment adequate for the number of persons or stations who must communicate with each other?			
<b>Concern</b>			

Every operator does not have an individual radio. Each plant is supposed to have a radio. No individual is responsible for their own radio.

**Recommendation**

Review radio situation in # 4 Crude unit. Institute changes (if necessary) so that an adequate number of radios are in ready-to-use condition for day-to-day operations. Review next scheduled shutdown plan to determine if existing radio inventory is adequate during shutdown period.

**Action Taken**

We will insure there is a radio for each operator working . In the event we don't have enough Plant Protection will maintain spare for operator use. We will also order additional radios for plant shutdown.

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Content Contact: Brennan, Matt (MTBR)  
Technical Contact: Sanjeev Polleball

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### *PHA/HE Quality Assessment Tool*

The following questions are provided to guide a reviewer in conducting a qualitative assessment of the quality of a PHA. Please indicate your response level to each question by checking the appropriate column.

No.	Quality Issue	Strongly Agree (3 points)	Agree (2 points)	Disagree (1 point)	Strongly Disagree (0 points)
1.	Is the PHA documentation:				
2.	Is the report consistent with current standards for Process Hazards Analysis				
3.	Does the report clearly state what the PHA was redone?				
4.	Does the report satisfy the following criteria?				
5.	Does the PHA address all potential hazards?				
6.	Was the selected PHA technique appropriate for the PHA?				
7.	Are any columns in the worksheet(s) for the causes/What-If/Causation analysis?				
8.	Are the causes/What-If/Causation analysis?				
9.	Do the causes/What-If/Causation analysis?				
10.	Are the consequences written clearly?				
11.	Have the consequence entries detailed the losses to a credible worst-case scenario (e.g., injury, spill/release, fire and/or operability/economic impacts)?				
12.	Was the Refining risk ranking matrix used to assess the need for and prioritize recommendations?				
13.	Have the risk rankings been applied consistently?				
14.	Have the severity rankings reflected the worst credible case losses, assuming all active safeguards have failed?				
15.	Are the recommendations worded so that they are "stand-alone" statements that can be understood independent of the worksheets?				
16.	Are the recommendations worded so that they have a measurable closure point?				

No.	Quality Issue	Strongly Agree (3 points)	Agree (2 points)	Disagree (1 point)	Strongly Disagree (0 points)
	Did the PHA address:				
17.	• The loss of utilities and other support systems?				
18.	• Incident reports, including "near misses," covering releases and injuries, of the unit or of similar units in the refinery or in industry (existing facilities).				
19.	• An evaluation of human factors?				
20.	• Facility siting or did the report reference supplemental work done to satisfy API RP 752?				
21.	• Modes of operation other than normal?				
22.	• Offsite consequences?				
23.	• Operability/economic issues?				
24.	Was the PHA team the most qualified or the most available?				
25.	Was a best practice master utilized?				
26.	Was PSI up-to-date prior to the PHA and available to team during the PHA?				
27.	If a Hazop, were the drawings updated prior to the PHA?				
28.	If the What-If/Checklist technique was employed, were quality checklists used and referenced in the PHA document?				
29.	Upon completion of the PHA, were findings actively communicated to affected employees and are they accessible?				

**Points**

78 - 87

Your PHA/HE appears to be of high quality.

53 - 77

Your PHA/HE is basically sound, but may have some opportunities for improvement. Determine areas that are deficient and develop an action plan to address in the next revalidation.

< 52

Your PHA/HE-MS may likely be ineffective. You may have incomplete studies that may not be addressing all of the hazards of the process. It is recommended that you initiate an action plan to assess and improve the effectiveness of the PHA/HE-MS.

2009 #4 Crude PHA - BIN Checklist Review

Each item listed on the Crude Unit BIN List was reviewed during 2009 #4 Crude PHA with the BIN Leader, Randy Sprouse. Following review of each item, if the PHA team found the existing safeguards adequate, the team addressed the item appropriately and noted accordingly in the PHA documentation.

During this review, comments have been noted, by exception, for each item:

- if the PHA team felt that additional explanation was needed.
- if the PHA team felt that the existing safeguards were not adequate, and PHA recommendation was generated.

Item 1: Primary heat exchanger train – over pressuring : Level Control valve relocated and eliminated issue.

Item 2: Atmospheric column overhead- corrosion: Generated Recommendation to review.

17. Concern is that existing corrosion probes are not routinely used to monitor corrosion rate in atmospheric column overhead. Review use of corrosion probes (awareness, maintenance, monitoring, etc.) in atmospheric column overhead.

Item 3: Furnace – ruptured tubes: Some skin Ti not working. Thermal scan used to verify skin Ti readings. Reviewed with operations. Will be managed through routine business.

Item 11: Desalter water carryover: Concern that desalter water carryover may be causing fouling issues in 2<sup>nd</sup> train (between P-1102 and furnace), carryover not yet verified. Capital project is in place to address plugging in secondary train.

Item 14: Atmospheric Column overhead temperature : Issue being addressed by on-going work with process engineering.

Item 25: Overpressure of heat exchanger train. PHA noted that El Segundo has overpressure protection on heat exchanger train; Richmond does not, though same design otherwise. Generated Recommendation to review.

18. Concern is that neither primary nor secondary heat exchanger trains have adequate overpressure protection. Per BIN review: El Segundo has similar exchanger train design as Richmond, only El Segundo has overpressure protection. Consider review of overpressure protection for primary and secondary heat exchanger trains are adequate.

Item 39: Ensure connections to hot pumps current piping specifications. Generated Recommendation to review.

24. Consider reviewing items listed from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PSI to reflect changes made.

Chevron Crude Unit HAZOP Checklist  
 Potential Crude Unit Incidents  
**Reviewed during 2009 #4 Crude PHA**

Location	Cause	Countermeasures – Key Elements
1	Primary Heat Exchanger train-overpressuring	Operate with bypasses partially open around desalter pressure controller and the flash drum level control valves. <b>11-09: System redesigned; do not operate with control valves bypassed. Level control valve relocated and eliminated issue.</b>
2	Atmospheric column overhead-corrosion	Atm. Overhead Corrosion Control BP
3	Furnace-ruptured tubes	Furnace Safe Firing Best Practice

Generated Recommendation to review.  
 17. Concern is that existing corrosion probes are not routinely used to monitor corrosion rate in atmospheric column overhead. Review use of corrosion probes (awareness, maintenance, monitoring, etc.) in atmospheric column overhead.

**11-09: Addressed in Node 2.**

**Chevron Crude Unit HAZOP Checklist**  
**Potential Crude Unit Incidents**

**Reviewed during 2009 #4 Crude PHA**

**Cause**

**Location**

		<b>Countermeasures – Key Elements</b>
	• localized coking due to poor desalting, flame impingement, feed contamination (leaded aviation gasoline will cause rapid fouling, filming amines in feed will also cause rapid coking)	11-09: Addressed in PHA. Some skin Ti not working. Thermal scan used to verify skin Ti readings. Reviewed with operations. Will be managed through routine business.
4	Furnace-explosions	<p>Inadequate skin temperature monitoring, poorly operating skin points, insufficient thermal scans. Furnaces have had detonations due to</p> <ul style="list-style-type: none"> <li>• Bogging a furnace (high levels of combustibles) due to outlet damper failure, rapid increase in furnace firing without increase in damper position, loss of forced draft fan or induced draft fan, faulty flue gas analyzers, inlet damper or register failure, loss of flames from burner (s)</li> <li>• Bogging a furnace due to explosion (see #3)</li> </ul> <p>Polythionic corrosion will occur with stainless steel tubes that are welded during a shutdown.</p> <p>Column trays can be dislodged causing poor separation in cuts, reduced feedrates, and in some cases a plant shutdown due to unstable column operation. Possible causes include:</p> <ul style="list-style-type: none"> <li>• wet stripping steam (see dry stripping steam best practice for recommendations)</li> <li>• refluxing water either due to inadequate dry out after shutdown or high level in udder of overhead reflux accumulator.</li> </ul> <p>Coking of wash oil packing causing high entrained metals in vacuum gas oil cuts. Causes are inadequate wash oil flow (.2 gpm/Ft<sup>2</sup> of true overflash ), holes in filters, or filters being bypassed</p> <p>Inadequate water removal from feed. Entrained</p>
5	Furnace-external corrosion	Vacuum Column Dry Stripping Steam Best Practice
6	Internal tray distress	<p>Design Practices:</p> <ul style="list-style-type: none"> <li>• Increased uplift resistance</li> <li>• Steam Spargers</li> </ul> <p>11-09: Spargers have been installed</p>
7	Coking of wash oil section	Wash Oil Integrity Best Practice <p>11-09: Min flow maintained, backups available per procedure.</p>
8	Corrosion of	Design Practices

**Chevron Crude Unit HAZOP Checklist**  
**Potential Crude Unit Incidents**

**Reviewed during 2009 #4 Crude PHA**

Location	Cause	Countermeasures – Key Elements
stabilizer overhead	chlorides in water can cause high corrosion rates. Properly designed water coalescer will remove water.	<ul style="list-style-type: none"> <li>Provide and maintain feed coalescer</li> </ul> <p><b>11-09: Feed coalescer in place. Corrosion addressed in PHA.</b></p>
9 Desalter—loss of oil level	With loss of oil level in desalter, electrical grids are suppose to shutdown to prevent arcing and damage to insulators.	<p><b>11-09: Vapor space s/d addressed in PHA.</b></p>
10 Desalter—oil undercarry	Fouled exchangers—effluent system problems	<p><b>11-09: Oil undercarry addressed in PHA</b></p>
11 Desalter water carryover	Pressure problems, column distress, possible loss of feed to furnace, foam over of flash tower	Capital project is in place to address plugging in secondary train.
12 Vacuum column-air leakage	Need to regularly monitor the vacuum column overhead gas rate, composition of vacuum seal drum off gas. High oxygen levels can create explosive mixtures.	<p><b>Key Process Variables:</b></p> <ul style="list-style-type: none"> <li>Monitor N2 content of vacuum offgas periodically (O2 not reliable as it can react with H2S).</li> </ul> <p><b>11-09: N2 content not monitored. Other measures (e.g., pressure) are used instead.</b></p>
13 Caustic injection-cracking	When using caustic injection to crude, excessive caustic injection can cause caustic embrittlement and cracks in tubes. Need to inject no more than 1 lb/1000 BBLs of crude	<p><b>Design Practice</b></p> <ul style="list-style-type: none"> <li>Premix caustic with clip stream of crude</li> <li>Injection nozzle designed to inject to center of oil flow</li> </ul> <p><b>11-09: part of current practices.</b></p>
14 Overhead temperature	Too cold of atmospheric column overhead temperature can lead to water condensation and chloride attack resulting in excessive corrosion.	<p>Atm. Overhead Corrosion Control Best Practice</p> <ul style="list-style-type: none"> <li>Water Dewpoint and NH4Cl Sublimation safety margins (Overhead temperature at least 25°F (14°C) above either)</li> </ul> <p><b>11-09: Corrosion probes in place; daily monitoring.</b></p> <p>Atm. Column Design Practices (where indicated)</p> <ul style="list-style-type: none"> <li>Monel trays at top of atmospheric column</li> <li>Monel or Hastelloy C lining to protect column shell.</li> </ul> <p><b>11-09: In place.</b></p>

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**Chevron Crude Unit HAZOP Checklist**  
**Potential Crude Unit Incidents**

**Reviewed during 2009 #4 Crude PHA**

Location	Cause	Countermeasures – Key Elements
15 Too wet overhead on stabilizer	Gas hydrates formed pressure problems	Provided feed water coalescing vessel to knockout excessive water.
16 Rapid loss of vacuum followed by rapid establishment of vacuum	Rapid change in column pressure can cause large amounts of liquid to be dumped in columns causing high bottom levels and in some cases tray damage	11-09: Feed coalescer in place. Corrosion addressed in PHA 11-09: Loss of vacuum addressed in PHA
17 Fire on bottoms pumps	Fire in column and vessel pumps can cause significant fires. Fire protection manual discusses needs for remote valve shutoff devices and water sprays above pumps with a large liquid reservoir in front of the exchangers.	EV's with fusible links 11-09: Addressed in PHA
18 Seal flush	Too light a seal flush, can cause seals to blow and possible fire	11-09: Addressed in PHA
19 Inadequate vacuum column overflash quench	Inadequate quench can cause coking of wash oil collector tray.	11-09: Addressed in PHA
20 Inadequate atmospheric column overflash	Inadequate atmospheric column overflash (typically 3-5 % of distillate) can cause coking of atmospheric column overflash trays.	Heat Exchanger Design Best Practice for Crude Units
21 Inadequate quench to vacuum column bottoms	Vacuum column bottoms should be below 650 °F (343 °C) can cause rapid coking/fouling of bottoms flow, reducing preheat and in some cases restricting bottoms flow	11-09: Addressed in PHA
22 Desalters—Insulating Bushing failure	Can crack and fail due to temperature cycling. Running too hot increases the risk; >350°F (175°C)	Routine inspection and replacement after cycling the unit. 11-09: Addressed in PHA
23 Desalter grid shorting out	See previous. Also using water clarifiers that can create gunk in water layer, which will ultimately short out grids	11-09: Addressed in PHA

Chevron Crude Unit HAZOP Checklist  
Potential Crude Unit Incidents

**Reviewed during 2009 #4 Crude PHA**

Countermeasures – Key Elements

Location	Cause	Countermeasures – Key Elements
24	Using high pH wash water that causes stable emulsion.	Tank management is first line of defense. In line monitoring (Agar probes or Density Meter) can be used to give operations early warning of water slugs. <b>11-09: Addressed in PHA</b>
25	Excessive Water in feed	Pumps hydraulic shutoff pressure is higher than exchanger rating and/or safety protection.
26	Overpressure of heat exchanger train	Provide inherently safe design or appropriate overpressure protection as needed. <b>PHA noted that El Segundo has overpressure protection on heat exchanger train; Richmond does not, though same design otherwise. Generated Recommendation to review.</b> <b>18. Concern is that neither primary nor secondary heat exchanger trains have adequate overpressure protection. Per BIM review: El Segundo has similar exchanger train design as Richmond, only El Segundo has overpressure protection. Consider review of overpressure protection for primary and secondary heat exchanger trains are adequate.</b>
27	Inadequate wash water injection to primary heat exchanger train	Pollution of primary heat exchanger train. Corrosion under deposits can lead to heat exchanger leaks. Should be injecting at least 2% wash water to cold crude.
28	Control valve bypass open	Potential for upsets, loss of column levels
28	High temperature H2S attack	Temperatures greater than 450°F (232°C) with high H2S levels can cause rapid high temperature H2S attack to carbon-steel.
29	Leaking atmospheric safeties	Leaking atmospheric safeties
31	Desalter effluent going to open drain	Desalter effluent water can when exposed to atmosphere release high amounts of benzene to personnel.

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Update April 2008

**Chevron Crude Unit HAZOP Checklist**  
**Potential Crude Unit Incidents**

**Reviewed during 2009 #4 Crude PHA**

Location	Cause	Countermeasures – Key Elements
32 Corrosion Under-Insulation	Overhead stabilizer line was insulated, allowing water to be trapped adjacent to the metal causing under-insulation corrosion leading to a LPG leak.	Inspection Program
33 Vortex breakers in flash drums	Vortex breakers that were not properly attached including tack welding of bolts to the column assembly, have flipped over causing the loss of flow.	Use metallurgy specified in the Atmospheric Column. Overhead Corrosion Control Best Practice
34 PMI PROGRAM	Recently a \$2 Million LPO, where a stainless steel nozzle in the overhead wash water line causing the nozzle to crack in the present of chlorides. The water leaked in the wrong direction, spraying the water and causing a leak in the overhead pipe Historically have seen heat exchanger leaks on startup of cold unit. (Has stopped since implementing hot bolting techniques.)	Prevention includes hot bolting techniques, graphonic gaskets, not insulating of heat exchanger channel section and head bolts. <b>11-09: Addressed in PHA</b>
35 Heat exchanger leaks	When processing crudes with high naphthenic acid content, can see rapid corrosion of carbon steel above 450°F/232°C.	Upgrade of metallurgy to 317L SS or selective upgrade with use of neutralizers is needed.
36 Naphthenic acid attack	We have experienced VDU top bed packing corrosion in a number of places. It appears to be chloride related and may be exacerbated by naphthenic acid. We have found 410 SS, 316 SS and 317 SS corroded. In crude unit biggest impact is pump suction screen plugging. Metals migration to downstream catalyst may be more serious.	Consider upgrading to Hastelloy C (N10276) packing.
37 Vacuum Column Top Bed Corrosion	Structured packing will burn! Assume that all column packing contains oil even after cleaning. There have been a number of fires in the industry due to hot work above packed beds.	Follow H&S guidelines. Do not weld above packed beds. Either remove the packing or provide a secure barrier.
37 Packing fires	High pH wash water can cause foaming in desalter and carbonate fouling of primary heat exchanger	Ideal is to maintain a pH below 7.0. However, acid injection facilities may be needed for control..
38 Ph of wash water injection		

**Chevron Crude Unit HAZOP Checklist**  
**Potential Crude Unit Incidents**  
**Reviewed during 2009 #4 Crude PHA**

**Countermeasures – Key Elements**

Location	Cause	Countermeasures – Key Elements
39 Hot Vacuum Resid Pump	A carbon steel wash oil line connected to a hot residuum pump failed due to sulfidation corrosion. A block valve between the pump and the wash oil line was missing its seat allowing hot material to migrate into the idle wash oil line. Wash oil line connection design was not per current piping specs.	Ensure connections to hot pumps current piping specifications.  11-09 Addressed in Node 75 24. Consider reviewing items listed from PHA spec break review to determine if piping/equipment is adequate for service and correct as needed. Update any relevant PSIs to reflect changes made.
40 Hot Vacuum residuum filter not properly isolated for Maintenance	A fire erupted when a filter basket was opened for maintenance. Basket was not properly isolated so hot oil sprayed out and ignited.	Ensure that procedures and instrumentation are in place to ensure safe and reliable isolation of hot oil systems before maintenance.
41 Cold Crude Feed Pump	Crude leaked and ignited due to vibration induced failure of a valve flange located between pump discharged and PSV.	Design PSV's to relieve to vapor space vs. liquid packed line to avoid excessive vibration. Ideally design Inherently safer systems to eliminate need for PSV's if possible.  11-09: Addressed in PHA

2009 D&R Crude Unit PHA

12/1/2009 M. Crow

Crew input was provided by the participation of the operator and his discussions with the operation and maintenance groups during this PHA.

**Crow, Mark A (MXEW)**

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**From:** Crow, Mark A (MXEW)  
**Sent:** Monday, November 23, 2009 3:18 PM  
**To:** Weaver, Bradley (BAWE)  
**Subject:** FW: #4 Crude PHA - Reliability Concerns  
**Attachments:** 2009 No 4 Crude PHA Recommendations.doc

**Follow Up Flag:** Follow up  
**Flag Status:** Flagged

Brad,

Thank you for your response regarding the two reliability concerns in the Crude unit. The PHA team added both of these concerns to the PHA and generated recommendations to address the issues. In the attached document, they are listed as recommendation 29 and 30. Please review. If you would like for me to update any of this information, I will be happy to do so. I also included you on the PHA close out meeting, scheduled for Tuesday, December 1, if you would like to attend.

Thanks again,

**Mark Crow**  
PSM Specialist / PHA Facilitator  
Richmond Refinery  
Chevron Products Company  
841 Chevron Way, T/C 333  
Richmond, CA 94802  
T)510-242-2071 F)510-242-5353

---

**Com:** Weaver, Bradley (BAWE)  
**Sent:** Monday, November 16, 2009 2:49 PM  
**To:** Crow, Mark A (MXEW); Smith, Joseph (JoeSmith); House, David (HOUE)  
**Cc:** Purvis, Benjamin (BPCQ); Cartier, Jacque-Michael (cartierjs); Cook, Donald L. (dlcd); Curry, David (DPCU)  
**Subject:** RE: #4 Crude PHA - Reliability Concerns

As for reliability,

I would like to see the seals upgraded on the P1195's to API elevated plan 23.  
Presently we are using API 21 and the coolers being used are borderline efficient.  
We have had great success in upgrading pumps in this division from 21 to 23.

As for safety,

I will continue to push for a more reliable vibration shutdown devices for the air cooled heat exchangers (fin fans)  
Presently we are using the Robert Shaw type, which continues to be unreliable in shutting the fan down.  
PMC Beta seems to work well in some of the other plants in our division.

Thanks

Brad

---

**From:** Crow, Mark A (MXEW)  
**Sent:** Tuesday, November 10, 2009 5:03 PM  
**To:** Weaver, Bradley (BAWE)  
: Purvis, Benjamin (BPCQ); Cartier, Jacque-Michael (cartierjs); Cook, Donald L. (dlcd); Curry, David (DPCU)  
**Subject:** #4 Crude PHA - Reliability Concerns

Brad,

We are completing the PHA for #4 Crude and I wanted to touch base with you regarding any concerns that you may want to address with the PHA team regarding reliability concerns with any equipment within #4 Crude or DEBRU. This may pertain to pumps, motors, compressors, etc. in which a failure may result in downtime or loss profit opportunity, but also in a loss of containment, fire, personnel injury or equipment damage. Please let me know either by email or phone if have any issues you would like to review with the team. Feedback by the end of the week would be appreciated.

Thanks,

**Mark Crow**  
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841 Chevron Way, T/C 333  
Richmond, CA 94802  
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### 3. Safety Information

This chapter familiarizes the operator with the safety hazards associated with the #4 Crude Unit. See Figure 3.1 for the #4 Crude evacuation route plan and location of safety and fire equipment.

This chapter is divided into the following sections:

- Responsibilities
- Process Safety management (PSM) Overview
- Potential Unit Hazards
- Personnel Safety Issues
- Unit Safety Systems and Devices
- Fire Protection Equipment
- Failure Prevention

#### 3.1 Responsibilities

Safety is the most important concern for every Chevron employee. Management has the legal responsibility to provide a safe workplace. However, safety is everyone's responsibility. Safety rules exist for the following three reasons:

- Personal safety and protection
- Safety of fellow employees
- Protection of equipment and facilities

All employees are responsible:

- To be aware of potential hazards within the unit
- To know unit normal and emergency operations and procedures
- To adhere to Chevron safety policies and procedures
- For the safety of all people that enter their work areas
- To know the location and proper use of all safety equipment on the unit

Failure to comply with all safety rules can result in disciplinary action, up to and including dismissal. This policy is designed for the protection of all employees.

Refer to the following for additional information about safety:

- Safe Work Procedures
- Safe Lock-Out and Tag-Out Procedure ([RI-9900](#))
- Unit Procedures Manual (UPM)
- Process Safety Management Manual (PSM)
- Hazards Communications Manual (HAZCOM)
- Unit Process Hazards Analysis (PHA)
- Material Safety Data Sheets ([MSDS](#)) for products on the unit
- Radioactive materials ([RI-9020](#))

### 3.2 Process Safety Management (PSM) Overview

On May 26, 1992, the Occupational Safety and Health Administration (OSHA) enacted legislation addressing management of the hazards associated with storage and use of chemicals in the work place. This legislation, 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, referred to as PSM, addresses 14 elements covering process design, operation, and maintenance. It applies to industries that store or use designated chemicals in quantities that potentially can be the source of catastrophic events such as fires, explosions and toxic releases. The 14 elements of the PSM regulation cover the following areas:

- Employee Participation - involves employees in developing PSM.
- Process Safety Information - defines process chemicals, technology, and equipment.
- Process Hazard Analysis - evaluates potential hazards.
- Operating Procedures - documents steps to operate the process safely.
- Training - ensures operators understand process hazards and how to safely operate the process.
- Contractors - ensures contractors operate safely and understand process hazards.
- Pre-Startup Safety Review - ensures new and modified processes are safe to operate.
- Mechanical Integrity - ensures equipment reliability.
- Hot Work Permits ([RI-341](#)) - establishes controls for potential fire sources.
- Management of Change ([RI-370](#)) - establishes controls for changing the process or its information.
- Incident Investigation ([RI-371](#)) - ensures incidents and near misses are investigated promptly and recommendations are implemented.
- Emergency Planning and Response ([RI-400/RI-480](#)) - establishes a plan and management for responding to emergencies.
- Compliance Audits - ensures programs are being used.
- Trade Secrets - makes all necessary information available.

### 3.3 Potential Unit Hazards

#### Chemical Inventory Specific Work Locations and Master MSDS & HMBP Book Locations

RI-313 - Hazard Communication Standard and Chemical Inventory Process is the single source reference for Chemical Inventory in the Richmond Refinery. Appendix 1 of this standard details the location for authorized official hard-copy binders for chemical inventory and Hazardous Materials Business Plans.

This section describes the potential hazards at the #4 Crude Unit. It is divided into the following sections:

- Potential Unit Hazards
- Hazardous Samples
- Radioactive Source Well for LT061 and LT081.
- Material Safety Data Sheets
- Chemical inventory list

Potential Unit Hazards

Many Potential Unit Hazards are present everyday in a refinery environment. These hazards, in the form of chemicals, gases, etc. are necessary in the #4 Crude Unit operating processes.

Operating personnel must identify those plant hazards, so that they may safely handle and work with them.

Table 3.3-1 Potential Unit Hazards, identifies the names and possible locations of hazardous materials at the #4 Crude:

**Table 3.3-1 Potential Unit Hazards**

MSDS #	Hazard	Location	Effect
N/A	Air leakage	Into vacuum column or overhead system	An oxygen leak into the vacuum system can result in an internal column explosion. Oxygen leakage into the overhead system will also cause sulfur deposition at the vent as compressors and plug the suction KO drum demister pad. This means a total shutdown of the vent gas recovery system. Continuously monitor O <sub>2</sub> content of the vent gas. If O <sub>2</sub> is detected, check for flange leaks, pump packing leaks, and open bleeders.
1368	Aqueous Ammonia (NH <sub>3</sub> )	<ul style="list-style-type: none"> <li>• T-1108 &amp; associated piping contain 10% BME gravity concentration NH<sub>3</sub>.</li> <li>• NH<sub>3</sub> is injected into C-1100 &amp; C-1160 overhead systems (pH control).</li> </ul>	Inhalation Hazard. Avoid contact with eyes and skin. Low vapor concentrations irritate the eyes and mucous membranes and can cause laryngitis and bronchitis. Higher concentrations can cause temporary blindness and violent coughing.
151	Benzene	Various crude oil streams and Desalter effluent.	Carcinogenic. Inhalation hazard. Avoid contact with skin, eyes and clothing. Always wear appropriate PPE when working around and/or sampling Benzene laden streams (See RI-348)
N/A	Sulfidic Caustic <ul style="list-style-type: none"> <li>• Total (Max 13% wt.% by NaOH)</li> <li>• Free (1.5wt% min- 5.0wt% max)</li> </ul>	<ul style="list-style-type: none"> <li>• T-1104 at plot limit and associated piping to inject mixer at V-1100 structure.</li> <li>• Caustic is injected into secondary feed via injection quill located upstream of F-1100A&amp;B.</li> </ul>	Severe contact and inhalation hazard. Skin contact will result in deep burns and/or ulcerations and permanent eye injury. Do not breathe vapors or mist. Wash down accumulated white flakes at packing glands. Use approved reamers to unplug vents and drains.

**Distillation & Reforming ABU  
#4 Crude Unit**

**Process and Equipment Description  
3. Safety Information**

MSDS #	Hazard	Location	Effect
EC2425A	Demulsifier	Desalter: injected into crude feed upstream of P-1101s	Inhalation hazard. Avoid contact with eyes and skin.  Hydrocarbon based material. Demulsifier is used to break oil away from surface of sediment and solid particles by reducing surface tension between them thereby allowing these particles to drop out with water phase.
EC2055A	Polymer	Polymer is periodically injected into Desalter effluent stream leaving unit after being processed by C-1180 Flash drum.	Contact and ingestion hazard. May cause irritation to skin and eyes. Avoid contact with skin, eyes and clothing.
DV001956	Furnace Stack Gases (Carbon oxides/CO/CO2)	F-1100A, F-1100B, and F-1160	Inhalation hazard. May cause dizziness, headache, and in high concentrations may cause brain damage and death.
301	Hydrogen Sulfide (H2S)	<ul style="list-style-type: none"> <li>• C-1100 &amp; C-1160 overhead hydrocarbon &amp; sour water systems.</li> <li>• Compressor area (K-1100s and K1171s).</li> <li>• V-1175 Degasser</li> <li>• V-1198 Relief drum and associated piping.</li> </ul>	Colorless poisonous gas with rotten egg odor. Extremely flammable. May be fatal if inhaled. Causes eye irritation. Heavier than air-may accumulate in low places such as pits, trenches, and sumps. The odor of rotten eggs is not a dependable indicator of presence of H2S at concentrations over 100ppm. When burned, hydrogen sulfide forms sulfur dioxide (SO2), a poisonous, colorless gas with a pungent odor.
N/A	V-1190 Sour Butane	<ul style="list-style-type: none"> <li>• C-1190 overhead &amp; associated piping.</li> <li>• E-1190's FinFan coolers.</li> <li>• V-1190 &amp; associated piping.</li> <li>• P-1190's.</li> </ul>	V-1190 sour butane is extremely flammable. It poses an immediate fire and explosion hazard when mixed with air. Sour butane is heavier than air and may collect in low areas or travel along the ground where there may be an ignition source present.
1041	Nitrogen (N2)	<ul style="list-style-type: none"> <li>• Purge gas for equipment.</li> <li>• Cleaning gas for K-1100s and K-1171s</li> <li>• Pressure test &amp; purge gas (vessels, columns, &amp; associated piping).</li> <li>• Column pressure control gas during shutdown.</li> </ul>	Inert gas-potential asphyxiant. Can cause rapid suffocation when concentrations are sufficient to reduce oxygen levels below 19.5%. N2 creates oxygen deficiency in vessels and around vessel openings when purged. Caution must be exercised when working on N2 purged equipment.  Do not enter nitrogen-purged vessels until atmosphere has been tested for N2 and O2 readings. Contact with N2 liquid or vapors can cause severe frostbite.
N/A	Oil	Spills	Slipping hazards. Wash down spills immediately. Washdown stations have been provided to assist in the cleanup of heavy oils.

Distillation & Reforming ABU  
#4 Crude Unit

Process and Equipment Description  
3. Safety Information

MSDS #	Hazard	Location	Effect
N/A	Process Gas	<ul style="list-style-type: none"> <li>• K-1100 Offgas Compressor (In and Out)</li> <li>• Vent Gas Compressor K-1171 (In and Out)</li> </ul>	See H2S. Process gas contains moderate concentrations of H <sub>2</sub> S. Utilize SCBA if leak is suspected.
	Pyrophoric (Iron Sulfides)	K-1196 Fuel Gas Coalescer	Iron sulfides from fuel gas may be present and begin to smolder when exposed to air when opening/removing filter element. Refer to <u>4CU-NP-4741</u> .
N/A	Radioactive material	<ul style="list-style-type: none"> <li>• 8s/c : LT081 Texas Nuclear</li> <li>• 8 s/c: LT081 KayRay</li> <li>• C-1160 Bottoms : LC061</li> <li>• Vacuum Overflash: LT072A</li> </ul>	The probes inside C-1160 contain a radioactive source material (Cs137 and Am-241-Be). During normal operation while inside the column there is no exposure hazard. Do not enter C-1160 until radioactive source probes have been removed enclosed in a specially provided lead container. See <u>RI-9020</u> and <u>4CU-NP-4725</u> .
N/A	Vacuum Residuum (C-1160 Bottoms)	<ul style="list-style-type: none"> <li>• C-1160 Bottoms</li> <li>• P-1165/A and associated piping</li> <li>• K-1165's and associated piping</li> <li>• E-1110, E-1163A&amp;B &amp; E-1165A&amp;B &amp; associated piping</li> <li>• Vacuum Resid sample station</li> <li>• Plot limit</li> </ul>	High temperature. Attempts to unplug openings will eventually release hot residuum suddenly, resulting in severe burns if hot oil contacts skin or clothing. Use special reaming tool to unplug hot residuum drains, vents, etc.
3730	Sour H <sub>2</sub> O	<ul style="list-style-type: none"> <li>• V-1100 (C-1100 O/H &amp; associated piping)</li> <li>• V-1104</li> <li>• V-1160 (C-1160 O/H, condensers &amp; associated piping)</li> <li>• V-1175</li> <li>• V-1190</li> <li>• V-1198</li> <li>• K-1100's &amp; K-1171's K/O pots and udders</li> </ul>	Sour H <sub>2</sub> O is a colorless liquid with ammonia and/or hydrogen sulfide (rotten egg) odor. Sour H <sub>2</sub> O is extremely flammable. Sour H <sub>2</sub> O is poisonous and may be fatal if swallowed. Sour H <sub>2</sub> O is corrosive and causes irreversible eye and skin damage. Sour H <sub>2</sub> O may release highly toxic and flammable hydrogen sulfide gas (H <sub>2</sub> S) and/or ammonia (NH <sub>3</sub> ) gas. Do not enter a release area without donning a self contained breathing apparatus.
N/A	Steam	50#, 150# and 800# psig Steam Systems. Located throughout 4 Crude Unit	High temperature & pressure. Steam leaks can be invisible due to elevated temperatures. Steam will cause severe burns and result in serious injury – even death. Do not check for steam leaks by waving hand over suspected flange leak, etc. Leaks must be recognized by other means (ie. heat, blown insulation, or noise).

Hazardous Samples

Table 3.3-2 identifies the most hazardous samplings in the #4 Crude Unit. These are:

- Desalter Effluent
- 8 S/C
- Vacuum Residuum
- V-1100, V-1160, and E-1160 H<sub>2</sub>O
- C-1190 OH Gas Bomb Sample
- V-1175 H<sub>2</sub>O
- V-1198 Liquid

Any sampling can be hazardous if taken improperly.

**Table 3.3-2 Hazardous Samples**

Sample	Hazard
Desalter Effluent	Desalter Effluent contains Benzene. Appropriate PPE must be worn when working around and /or sampling this stream. Minimum half face respirator with organic cartridges.
8 S/C	8 S/C is sample is extremely hot and extra caution should be exercised when obtaining a sample. Minimum use of leather gloves to prevent personnel burns.
Vacuum Residuum	Sample line may plug. Clearing of line or valve may result in sudden release of hot residuum. Sample hot residuum only at established sampling stations using appropriate PPE which consists of specialized heat resistant gloves and faceshield to prevent burns. If lines are plugged, use special reaming tool to unplug. Refer to Job Aid <u>4CUBE01</u> .
V-1100, V-1160, and E-1160 H <sub>2</sub> O	See H <sub>2</sub> S and ammonia hazards on Table 3.3-1.
C-1190 OH Gas Bomb Sample	Refer to Job Aid <u>4CUBE02</u> .
V-1175 H <sub>2</sub> O	See H <sub>2</sub> S and ammonia hazards on Table 3.3-1.
V-1198 Liquid	See H <sub>2</sub> S and ammonia hazards on Table 3.3-1.

**Radioactive Source Well for LT061 and LT081.**

Refer to RI-9020 for guidance on radioactive materials. See Table 3.3-3 for a listing of #4 Crude Unit radioactive materials as of end of year 2001. Refer to the Refinery Radiation Information Web page for updated information.

Table 3.3-3 #4 Crude Unit Radiation Sources (end of year 2001)

Nuclide # on License	Location	Isotope strength	Manufacturer/ Model # (source housing #)	Serial #	Status	Permit Date	Last Wipe Test	Last Area Survey	Wipe/ Survey Due Date	Survey/ Wipe Test frequency
6. I.	C-1160 - #8 Sidecut	Am-241-Be (500mCi)	Kay Ray Model #4160 (Source Housing #7100B)	29089	Active	11/20/90	6/5/01	6/5/01	December , 2001	Twice a year
6. J.	C-1160 Bottoms	Cs137 (1000mCi)	Kay Ray Model #4760 (Source Housing #7063S)	29090	Active	11/20/90	6/16/99	6/5/01	June, 2002	Every 3 years
6. I.	C-1160 Overflash	Am-241-Be (500mCi)	Kay Ray Model #7700-500 (Source Housing #7100B)	30089	Active	9/25/91	6/5/01	6/5/01	December , 2001	Twice a year
6. R.	C-1160 - # 8 sidecut	Cs137 (8000mCi)	Texas Nucl. Mod. #5204(Source Housing # 57157C)	B-340	Active	10/21/96	6/16/99	6/5/01	June, 2002	Every 3 years

Only qualified Chevron personnel shall handle radioactive sources for replacement, calibration of instruments, or any other maintenance work. The Area Business Unit Manager is responsible for ensuring that the radioactive source is used only for the application it was approved for and is used in compliance with manufacturer's instructions.

The Area Business Unit Manager is additionally responsible for ensuring that the safety in design, installation, and physical security of the radioactive source has been verified by the Division.

If a radioactive source rod should accidentally be damaged or come apart in the well, evacuate the area and report the incident to Plant Protection and the Refinery Senior Safety Engineer immediately.

The source rods are not to be removed from the immediate plant area except by qualified Chevron personnel. When taken from the area they must be put in a proper carrier and released only by special permit endorsed by the Area Business Unit Manager.

In accordance with applicable provisions of Refinery Instruction RI-9020, the Radiation Safety Officer (RSO) and alternate RSO have the primary responsibility for all licensed radioactive sources. The RSO shall be involved with the moving, dismantling, and disposing of radioactive sources. The RSO will also maintain the radioactive source permit and inventory records.

Radioactive sources will be stored in a properly shielded and locked container located near the column where regularly used. The Qualified Supervisor will lock and unlock the container. A "CAUTION RADIOACTIVE MATERIAL" sign must be on the container when it contains a radioactive source.

#### Material Safety Data Sheets (MSDS)

Material Safety Data Sheets (MSDS) proved critical information for all potentially hazardous chemicals present in the #4 Crude Unit. MSDS binders are located in the LSFO Control Center. MSDS information can also be found on the refinery web page under the reference section.

The MSDS for each chemical provides information on:

- Trade names
- Hazardous ingredients
- Physical and chemical characteristics

- Fire and explosion hazard data
- Known acute and chronic health effects and related health information
- Exposure limits
- Spill or leak procedures
- Personal protective equipment requirements
- Special precautions for handling or using hazardous chemicals
- Whom to contact for further details

Chemical inventory list

The Richmond Refinery maintains a facility-wide Chemical Inventory System to support the OSHA Hazard Communication Standard and Hazardous Materials Planning needs. Table 3.3-4 provides a "snapshot" of the #4 Crude Unit chemical inventory of hazardous chemicals as of 11-01-01. Refer to the Refinery Chemical Inventory Reports for the most current list.

Table 3.3-4 Chemical Inventory List

Substance Name	MSDS	Substance ID	Normal Amt	Units
ACTIVATED CARBON (CALGON)		S5692	120000	L
ANTIFREEZE		S40519	4	B
BENZENE		C71432	155	G
CAL ARP/RMP MXD FLAM HYDROCARB		S50349	51019	L
CERAMIC FIBERS		S16200	0	
CHEVRON AQUA AMMONIA	1368	CC03016100	92000	G
CHEVRON ATF DEXRON-III/MERCON	21	CPS226502	10	G
CHEVRON ATF SPECIAL	404	CPS226587	10	G
CHEVRON CUSTOM M/O SAE 15W-50	838	CPS220109	10	G
CHEVRON CYLINDER OIL 460X	537	CPS230334	100	G
CHEVRON EP INDUSTRIAL OIL 150X	30	CPS231737	10	G
CHEVRON EP INDUSTRIAL OIL 46X	90	CPS231734	100	G
CHEVRON GST OIL 100	246	CPS234232	0	G
CHEVRON GST OIL 32	221	CPS234229	1000	G
CLOROX LIQUID BLEACH		S1000	0	G
CRUDE OIL	2493	CPS296000	73000	B
EC2425A		S50936	500	G
GAS OIL, LIGHT	5150	NN00005150	20000	G
GASES, REFINERY FUEL	2564	NN00002564	227	F

Table 3.3-4 Chemical Inventory List

Substance Name	MSDS	Substance ID	Normal Amt	Units
HELIUM		C7440597	100	F
HI-FLASH NAPHTHA (UNSTABILIZED)		C8030306	206171	L
HYDROGEN SULFIDE (H2S)		C7783064	221	L
INSULATING OIL		S5896	0	G
LEAD ACETATE		C301042	2	L
LEAD ACETATE - IN BATTERIES		S49731	0	O
LEAD BASED PAINT		S49781	0	G
MAN-MADE MINERAL FIBERS		S40290	0	L
MERCURY-IN-GLASS THERMOMETER		S49729	0	O
NALCO EC2050A		S51046	1500	G
NALCO EC2055A DESALTING RVRSE		S51047	200	G
NEUGENIC 4176		S51676	250	G
NICKEL CADMIUM - IN BATTERIES		S49730	0	O
NITROGEN		C7727379	280	F
POLYCHLORINATED BIPHENYLS/PCB		S10826	0	G
REFORMATE NAPHTHA, HEAVY	4481	CPS203013	10000	G
SODIUM HYDROXIDE SOLN, SPENT	2665	NN00002665	250	G
UTILITY WATERS		S15624	40000	G
VACUUM GAS OIL		S1809	8330	G
VACUUM TOWER BOTTOMS	5144	NN00005144	28000	B
WASTE WATERS/OILS	2638	S15625	1980	G
WELDING&CUTTING : FUMES&GASES	2710	NN00002710	0	F

Data correct as of November 01, 2001 – See [Chemical Inventory Reports](#)

### 3.4 Personnel Safety Issues

This section describes some of the protective measures that personnel in the #4 Crude Unit need to take to ensure their safety and the safety of others. This section is divided into:

- Color Coding of Lines and Valves
- General Safety Rules

- Personal Safety Equipment
- Control House Information
- Visitors

#### Color Coding

Color Coding designates certain hazards in the #4 Crude Unit. Color coding, done in accordance with RI-302, is divided into the following categories:

- Color Coding of Lines
- Color Coding of Valves

Table 3.4-1, Color Coding of Lines, identifies specific colors and associated types of special purpose equipment.

**Table 3.4-1 Color Coding of Lines**

Color (Lettering on Background)	Equipment/Lines
Black on White	LPG
Black on Aluminum	Ammonia
Black on Cream	Drinking, Cooling, and Utility Water
Yellow on Blue	Nitrogen/CO <sub>2</sub> /Other Inerts
Black on Blue	Steam, Condensate, and Boiler Feed Water
Red on Blue	Utility and Instrument Air
White on Green	Gasoline, Jets, Naphthas, Thinners, and Solvents
Yellow on Green	Natural Gas and Sweet Fuel Gas
Red on Green	Hydrogen
White on Black	Gas Oils, cycle Oils, Crude Oils, Diesels, and Heavy Oils
Black on Yellow	Toxic or Corrosive Chemicals, Additives, Acid, Caustic, Sour Stocks/Streams
White on Red	Fire Water Lines
Black (entire line is black)	Fire Foam Systems
White on Orange	Environmental (recovered oil)
Black on Yellow (entire line is yellow)	Lines containing pure H <sub>2</sub> S
White on purple	Reclaimed Water Lines
Fluorescent Green spray/brush	Dismantling Pipes/Equipment
White on Blue	Non asbestos-Containing Material

#### General Safety Rules

The General Safety Rules are designed to help personnel prevent accidents and properly treat injuries. Specific safety rules may be added to these general rules as conditions require. All employees must comply with these rules.

### Personal Safety Equipment

This section describes personal safety equipment and emergency safety equipment on the #4 Crude Unit. Personal safety equipment includes:

- Protective clothing
- Respiratory equipment
- Safety Shower/Eye Wash Stations
- Hearing Protection

Operators must know the location and use of all safety equipment on the unit. A map showing the location of all safety equipment in the #4 Crude Unit is located in Figure 3.1

**Protective Clothing.** The following list identifies required equipment:

- Hard hats
- Safety glasses
- Sturdy leather shoes or boots with notched heals
- Nomex coveralls

The following items are required, based on particular personnel actions:

- Safety gloves
- Chemical-resistant gloves
- Leather gloves and clothing
- Acid suits
- Chemical boots
- Chemical goggles
- Welding goggles
- Face shields
- Respiratory Protection
- Hearing Protection

**Respiratory Equipment.** Self Contained Breathing Apparatus (SCBA) are used for any emergency requiring the use of fresh air. SCBA's are strategically located within the #4 Crude Unit. Figure 3.1 shows the locations.

Table 3.4-2 describes the SCBA locations for the 4 Crude unit and associated equipment.

**Table 3.4-2 SCBA Locations**

SCBA Number	Regulator Number	Location
P20	129905	West side of Resid sample draw
P21	039904	West side of MCC
P22	070019	East side of MCC

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SCBA Number	Regulator Number	Location
P23	040015	West side of MCC
P35	060004	T-3144
P36	070045	South side C-1120
P37	080205	North east corner PLM
P38	080203	K-1171A
P39	080202	E-1108
P40	090010	North west corner F-1160
P41	070026	North east corner F-1160
P42	060016	C-1190
P60	020167	K-1000's deck
P61	020116	K-1100's deck
P34	080201	DEBRU
	040056	South west corner Cooling tower
T8P6	060027	Thermal flare
T8P7	069939	Thermal flare
T8P8	079928	Thermal flare
	070021	P-1250 D&R flare
	029969	P-1250 D&R flare
P43	070035	LSFO flare
	060036	LSFO flare
	059930	LSFO flare
	070009	LSFO flare
P50	080204	Control house
P51	070014	Control house
P52	060003	Control house
	080037	T-3126
	090044	T-3126
	039911	T-3126
	070025	T-3128
	060026	T-3128
	030031	T-3128

**Safety Showers and Eyewashes.** Safety Shower/Eye Wash stations are provided in case of accidental exposure to process chemicals. The purpose of the safety shower and eyewash is to provide an immediate water flush for the body or eyes. Neither the safety shower or eyewash should take the place of additional first aid that may be required. Figure 3.1 lists the locations of the safety showers and eye wash stations.

#### Eyewash and Safety Showers

Eyewash and Safety Showers are located;

- North of V-1198 Relief Drum
- East of T-1108 Ammonia Tank
- Below E-1128B-1 (Eyewash Only / No Alarm)
- Below E-1190A-1 (Eyewash Only / No Alarm)

A hard alarm will sound on the Crude Unit DCS console in the control room when any shower is activated. The alarm indicates someone is using the shower or eyewash station. The Plant Operator must respond immediately to assist the person using the shower.

An eyewash station is part of the safety shower. It is used to flush any foreign material out of the eye quickly. It is not to take place of any first aid that may be required. Refinery drinking water supplies the safety showers and eyewash stations.

Portable eyewash stations are available from the Central Tool Room for use during any special activity to include but, not limited to chemical cleanup of equipment for maintenance.

The Safety Shower locations are shown in Figure 3-1.

**Hearing Protection.** The maximum exposure allowed by OSHA averaged over an eight hour shift is 90 dBA. As a general rule, a hearing protector should be selected that will reduce the noise to a level of 70 dBA maximum. This will provide an adequate margin of safety to account for situations where the fit is less than perfect. Employees are encouraged to voluntarily use hearing protectors when they feel the use is justified by their particular work condition. In general, hearing protection should be carried and worn in most operating plants and areas where loud power equipment is used. Certain locations in the Refinery, identified by orange lines and warning signs, are designated as mandatory hearing protection areas. These areas may not be entered without hearing protection being worn.

#### Control Center Information

Information pertaining to the Control Center ventilation operation is located in the Utilities Operating Standard, Section 22 "Control Center." Refer to Item 22.2.5 "Air Conditioning." This information relates to both the Distillation and Reforming sides and should be used in case of a hazardous release in the Control Center Area.

#### Visitors

Personnel wanting to enter the unit will contact the Head Operator or Process Control Operator, before working on equipment or visiting any part of the plant. All personnel, not assigned to operating the unit, will be required to follow the sign in procedure as specified in RI-375. All visitors will be required to wear hard hats, safety glasses, long sleeves and substantial leather shoes. D&R Business Unit policy requires that all visitors wear Nomex coveralls if going into an operating unit.

### 3.5 Unit Safety Systems and Devices

The #4 Crude Unit has the following systems to prevent or limit the severity of incidents on the Unit:

- Plant Layout
- Safety Critical Devices (Critical Instruments)

- Fail Safe Controller (FSC)
- Alarms
- Plant Evacuation Alarm
- Pressure Relief Devices (PRD's)
- Emergency Block Valves (EBV's)
- Hot Oil Pump Vents
- Pumpout System

#### Plant Layout

Extra care was taken to avoid low clearance cross-bracing on steel structures such as the atmospheric and vacuum overhead structures and furnaces. This was done in addition to the traditional headroom allowances normally made for valves, lines, and overhead obstructions above access isles. Instrument conduits and cable trays have been located in the center of the main pipeway, 30 feet above grade in the third pipe rack. This location gives extra protection in case of a fire and allows the operator extra time for a safe and controlled shutdown should the situation dictate a shutdown.

#### Safety Critical Devices

Safety critical devices are instruments, analyzers, electrical devices or systems whose failure to operate could cause:

- A serious threat to plant personnel or community (loss of containment with explosion, fire or exposure to hazardous material).
- Serious equipment damage with associated risk to plant personnel or community.
- A serious environmental or industrial hygiene risk to plant personnel or community health and safety.

Safety critical devices prevent, significantly reduce or detect loss of containment. If one of these devices fails, an operator must take immediate steps to ensure continued safe operations and to repair the failed device.

#### Honeywell Fail Safe Controller

The Fail Safe Controller (FSC) is to protect personnel and equipment and prevent the potential release of hazardous materials. The FSC is completely automatic and can execute a shutdown without operator assistance. Reference Appendix I in the #4 Crude Unit Process Description for the FSC Shutdown Matrix showing conditions that will initiate a shutdown and the associated alarms.

#### Alarms

Alarms warn operators that a process parameter such as temperature, level pressure or flow is out of the safe or desired range.

The five types of alarm area:

- Digital alarms alert operators when a parameter is off normal, i.e., when a pump or fin-fan is off.

- Low alarms indicate a parameter is beginning to approach the safe lower operating range.
- Low-Low alarms indicate that the parameter is very near the safe lower operating range.
- High alarms indicate the parameter is beginning to approach the safe upper operating range.
- High-High alarms indicate that the parameter is very near the safe upper operating range.

Operators should take immediate steps to correct all alarmed parameters. Consequence of Deviation (COD) tables identify unit alarms, tag numbers, trip points, alarm priorities, the potential consequences associated with getting the alarm, potential causes and corrective actions.

#### Plant Evacuation Alarm

The 4 Crude Unit is equipped with a plant evacuation alarm which is activated via a handswitch on the 4 Crude DCS console. Whenever the evacuation horn is sounded, the Plant Operator should ensure that all personnel within the plant have been evacuated to the appropriate assembly area or shelter-in place location. Figure 3.1 shows the location of assembly areas for the 4 Crude Unit in the event of a plant evacuation. When evacuating the unit personnel must pay attention to the following:

- Check wind direction via windsocks or steam issuing from vents.
- Never walk into or across the path of a vapor release.
- Assist contract, maintenance or non-assigned personnel to the appropriate assembly area.
- Ensure any Hotwork is shut down including welding machines, generators etc.
- Assist Control Operator in verifying accountability of all personnel as per plant sign-in roster.

#### Pressure Relief Devices

Pressure Relief Devices (PRDs) protect equipment from damage by excessive pressure or vacuum inside it. PRDs open upon reaching a preset pressure. When the pressure falls below the setpoint, the valve closes again. PRDs should be inspected after any incident. PRDs are also inspected on a regular basis during major plant turnarounds. See HES web for PRD details: Pressure Relief Devices

Table 3.5-1, #4 Crude Unit Pressure Relief Devices, lists each pressure relief device, its tag number, and its set pressure.

**Table 3.5-1 #4Crude Unit Pressure Relief Devices**

Relieved Equipment	Equipment Number	Design Tag Number	Set Pressure (psig)
Atmos. Column Overhead	C7-1	PSV056	50 psig
Atmos. Column Overhead	C7-2	PSV057	50 psig
Atmos. Column Overhead	C7-3	PSV058	50 psig
Atmos. Column Overhead	C7-4	PSV059	50 psig
Atmos. Column Overhead	C7-5	PSV063	50 psig

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Relieved Equipment	Equipment Number	Design Tag Number	Set Pressure (psig)
P-1107 Corrosion Inhibitor Injection Pump	C7-6	PSV071	250 psig
P-1106 Desalting Chemical Injection Pump	C7-7	PSV062	150 psig
V-1109 Desalter Water Tank	C7-8	PSV561	30 psig
V-1102 Outlet	C7-9	PSV562	242 psig
V-1102 Outlet	C7-10	PSV563	250 psig
V-1102 Entrance Bushing	C7-11	PSV566	100 psig
V-1102 Entrance Bushing	C7-12	PSV567	100 psig
V-1102 Entrance Bushing	C7-13	PSV568	100 psig
Desalting Water / E-1123 Outlet	C7-14	PSV544	375 psig
Anti-Foam / V-1111 Outlet	C7-15	PSV1104	260 psig
V-1103 Vapor Outlet	C7-16	PSV575	100 psig
T-1108 Aqueous Ammonia	C7-19	PSV571	No Info
Aqueous Ammonia From T-3146 (5H2S)	C7-21	PSV576	255 psig
F-1100A LPBFW Heating Coil	C7-22	PSV064	210 psig
F-1100B LPBFW Heating Coil	C7-23	PSV164	210 psig
F-1100A&B Super Heated Steam Coil	C7-24	PSV162	180 psig
V-1104 Naphtha Coalescer	C7-25	PSV061	215 psig
K-1100A Lube Oil CW Return	C7-29	PSV234	90 psig
V-1170 Off Gas K/O Pot	C7-31	PSV677	50 psig
K-1100A 1 <sup>st</sup> Stage Discharge	C7-32	PSV755	52 psig
E-1169A CW Return	C7-33	PSV675	90 psig
K-1100A 2 <sup>nd</sup> Stage Suction	C7-34	PSV775	65 psig
K-1100A 2 <sup>nd</sup> Stage Discharge	C7-35	PSV757	145 psig
K-1100B 1 <sup>st</sup> Stage Discharge	C7-36	PSV756	52 psig
E-1169B CW Return	C7-37	PSV676	90 psig
K-1100B 2 <sup>nd</sup> Stage Suction	C7-38	PSV776	65 psig
K-1100B 2 <sup>nd</sup> Stage Discharge	C7-39	PSV758	120 psig
K-1100B Lube Oil CW Return	C7-40	PSV237	90 psig
K-1171 Internal Oil Cooler	C7-44	PSV334	90 psig
K-1171 Vent Gas Recovery Compressor 1 <sup>st</sup> Stage Discharge	C7-45	PSV 771	42 psig
E-1172 Vent Gas Recovery Compressor Interstage Cooler (Cooling H2O Return)	C7-46	PSV766	90 psig
V-1172 Vent Gas Recovery Compressor 2 <sup>nd</sup> Stage K/O Drum	C7-47	PSV767	55 psig
K-1171 Vent Gas Recovery Compressor 2 <sup>nd</sup> Stage Discharge	C7-48	PSV768	145 psig
K-1171A Lube Oil CW Return	C7-51	PSV337	90 psig
K-1171A Vent Gas Recovery Compressor 1 <sup>st</sup> Stage Discharge	C7-53	PSV772	42 psig

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Relieved Equipment	Equipment Number	Design Tag Number	Set Pressure (psig)
E-1172A Vent Gas Recovery Compressor Interstage Cooler (Cooling H2O Return)	C7-54	PSV765	90 psig
V-1172A Vent Gas Recovery Compressor 2 <sup>nd</sup> Stage K/O Drum	C7-55	PSV773	55 psig
K-1171A Vent Gas Recovery Compressor 2 <sup>nd</sup> Stage Discharge	C7-56	PSV769	145 psig
V-1175 Degasser	C7-57	PSV761	30 psig
E-1171A Vent Gas Recovery Compressor Precondenser (Cooling Water Return)	C7-58	PSV762	90 psig
V-1171 Vent Gas Recovery Compressor 1 <sup>st</sup> Stage K/O Drum	C7-59	PSV763	25 psig
E-1171 Vent Gas Recovery Compressor Precondenser (Cooling Water Return)	C7-60	PSV764	90 psig
C-1190 Stabilizer	C7-63	PSV921	90 psig
V-1197 Stabilizer Reboiler Drainer	C7-64	PSV922	165 psig
V-1190 Stabilizer Reflux Drum	C7-65	PSV923	110 psig
C-1180 Flash Drum	C7-66	PSV118	60 psig
P-1165 Lube Oil System (Cooling H2O Return)	C7-71	PSV971	150 psig
PT-1165A C-1160 Btms. Pump Turbine	C7-72	PSV065B	185 psig
P-1165A Lube Oil System (Cooling H2O Return)	C7-73	PSV972	150 psig
C-1160 Vacuum Column	C7-79	PSV624	30 psig
E-1160A&B Cooling H2O Inlet	C7-80	PSV623	90 psig
E-1161 & E-1162 Cooling H2O Inlet	C7-81	PSV678	90 psig
V-1160 Vacuum Seal Drum	C7-82	PSV673	30 psig
V-1164 50# Steam Knockout Drum	C7-84	PSV684	75 psig
F-1160 Superheated Steam Coil	C7-85	PSV619	70 psig
F-1160 BFW Coil	C7-86	PSV679	210 psig
V-1177 150# Steam Drum	C7-87	PSV722	185 psig
V-1177 150# Steam Drum	C7-88	PSV723	190 psig
V-1196 Fuel Gas K/O Drum	C7-92	PSV944	120 psig
V-1198A Relief Drum Water Boot	C7-94	PSV	175 psig
Desalter Effluent (above ps#4)	C7-95	PSV3302	200 psig
P-1198 Relief Drum Pump	C7-97	Info.unavailable	500 psig
Wild Naphtha From JHT (Plot Limit)	C7-98	Info.unavailable	250 psig
DHT V-1650 Naphtha to V-1103	C7-99	Info.unavailable	275 psig
E-1116A VBCR Outlet	C7-105	PSV161	440 psig

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Relieved Equipment	Equipment Number	Design Tag Number	Set Pressure (psig)
E-1116C Crude Outlet	C7-106	PSV162	570 psig
E-1116D VBCR Outlet	C7-107	PSV163	440 psig
E-1116F Crude Outlet	C7-108	PSV164	570 psig
Exit piping on outlet of K-1181A	C7-109	PSV081A	425 psig
Exit piping on outlet of K-1181B	C7-110	PSV081B	425 psig
E-1178 150# Steam Outlet	C7-111	PSV078A2	120 psig
Exit piping on outlet of K-1168A	C7-113	PSV68A	505 psig
Exit piping on outlet of K-1168B	C7-114	PSV68B	505 psig
E-1178 Vac.Overflash Outlet	C7-130	PSV078A1	120 psig
Vacuum Resid (Plot Limit) FV-1165-2 piping	C7-134	PSV134	740 psig
Vacuum Residuum To 5 Tar Line(Plot Limit)	C7-135	PSV135	285 psig
F-1100A Stack Damper Reserve Air Tank	C7-136	PSV136	150 psig
F-1100B Stack Damper Reserve Air Tank	C7-137	PSV137	150 psig
F-1160 Stack Damper Reserve Air Tank	C7-138	PSV138	150 psig
K-1165A Resid Filter	C7-142	Info.unavailable	420 psig
K-1165 Resid Filter	C7-143	Info.unavailable	420 psig
K-1196 Fuel Gas Coalescer	C7-144	PSV961	150 psig
T-1104 Caustic Tank	Info.unavailable	PSV004	-.5oz/in+/.5oz/in
P-1104 Caustic Injection Pump	Internal PSV	Internal PSV	600 psig
4 Or 6 S/C From E-1149 (Plot Limit)	C2-80	Info.unavailable	240 psig
Desalter Effluent to 3126Tk	C2-85	Info.unavailable	240 psig
3 S/C From E-1139 (Plot Limit)	C2-86	Info.unavailable	240 psig
K-1100A Off Gas Comp. Distance Piece / Cylinder Packing	Info.unavailable	PSE781	15 psig
K-1100B Off Gas Comp. Distance Piece / Cylinder Packing	Info.unavailable	PSE782	15 psig
K-1171 Vent Gas Comp. Distance Piece / Cylinder Packing	Info.unavailable	PSE783	15 psig
K-1171A Vent Gas Comp. Distance Piece / Cylinder Packing	Info.unavailable	PSE784	15 psig

**Emergency Block Valves (EBVs)**

Emergency Block Valves (EBVs) are installed in the suction lines to pumps at most major vessels that could contribute large amounts of hydrocarbons to pump seal leaks. These valves are operated by a loss of air pressure. In case of fire at high temperature, the fusible plug melts, which allows the air to bleed off and the spring loaded valve to close.

NFPA specifies installation, in short, where valve access could be slow, difficult, or dangerous in the event of a pump seal fire. EBVs close when air pressure is bled off the control circuit. They can be activated by the following means:

- Fusible plug over pump seal area
- Hand switch at remote EBV field test panel
- Hand switch at EBV remote activation panel

There are no alarms indicating an EBV has gone to the tripped position, but other alarms associated with pump flows or discharge pressures will occur. When an EBV is in the tripped position (closed) the associated pumps are interlocked to shut down to avoid mechanical damage to the pumps. Pumps cannot be started when the EBV circuit is in the tripped state.

A magnetic valve stem position switch triggers pump shutdown when an EBV closes. It is important that the shielding around this device be kept in place to avoid accidental tripping by wrenches, persuaders, etc., which may be brought close to the trip mechanism. It's important that mechanics working on the valve understand that steel tools can inadvertently cause the trip to activate. EBVs are to be tested on a regular basis and are included in the #4 Crude Outside Operators Routine Duties.

It is imperative to ensure that the pump on the EBV to be tested is Not In Service. When testing EBVs;

- Ensure that the pump on the EBV to be tested is not in service.
- Turn the hand valve at the test panel to S/D position – The gauge pressure drops to 0 psig.
- EBV will close. Have PCO verify indication on Honeywell console.
- Push the start button on pump – Pump should not start.
- Turn hand valve at test panel to run position – Gauge pressure returns to 25 psig.
- EBV will open.
- You will need to manually relatch and open EBV021 (P-1165) and EBV022 (P-1165A)
- “Bump” start button on pump to ensure it will start after EBV opens.
- Reset down pump on standby APS mode.

Table 3.5-2, #4 Crude Unit EBV Locations, lists numbers, and associated pumps.

Table 3.5-2 #4 Crude Unit EBV Locations

EBV Location	EBV Number	Local Switch Location
P-1105 Suction	EBV001	
P-1105A Suction	EBV002	
P-1105 Atmos. Column Bottoms	EBV055	Adjacent to V-1199
P-1105 Seal Flush	EBV005	Adjacent to V-1199
P-1105A Atmos. Column Bottoms	EBV056	Adjacent to V-1199
P-1105A Seal Flush	EBV006	Adjacent to V-1199
P-1128 Atmos. Top Circulating Reflux	EBV017	Adjacent to P-1128/A

EBV Location	EBV Number	Local Switch Location
P-1128A Atmos. Top Circulating Reflux	EBV018	Adjacent to P-1128/A
P-1188	EBV019	Adjacent to P-1188/A
P-1188A	EBV020	Adjacent to P-1188/A
P-1188 Seal Flush	EBV088	Adjacent to P-1188/A
P-1188A Seal Flush	EBV089	Adjacent to P-1188/A
P-1165 Seal Flush	EBV065	Adjacent to P-1165/A
P-1165A Seal Flush	EBV066	Adjacent to P-1165/A
P-1165 Suction	EBV021	Adjacent to P-1165/A
P-1165A Suction	EBV022	Adjacent to P-1165/A
P-1190	EBV090	Adjacent to P-1190/A
P-1190A	EBV091	Adjacent to P-1190/A

\* All EBVs can be activated remotely via the control panel located next to K-1100B.

#### Emergency Shutdown System

An emergency shutdown system has been provided to protect the Crude Unit during several emergency situations and when an orderly, routine shutdown is not possible.

This system includes 11 hand switches mounted on the Honeywell console. This system enables the operator to shutdown the unit safely by utilizing short loop circulation for cool down.

The hand switches and their function are as follows:

- HS001 HC003 A/B, shuts off the fuel gas to F-1100A.
- HS011 HC013 A/B, shuts off the fuel gas to F 1100B.
- HS087 HC087 opens and sends 7s/c into the 8s/c pumpback system. If the HC is set in the closed position, the valve will not open.
- HS061 HC621 A/B, shuts off the fuel gas to F-1160.
- HS065 FC065 shuts off the residuum rundown to offplot.
- HS004 HC004, and routes C-1160 Bottoms to F-1160.  
When HS004 is activated, check HC004. If the HC is set in the closed position, the valve will not open. Also, note that HC004 may have to be partially closed to create enough backpressure to satisfy the quench requirement of 17,500 BPD (i.e., maintain quench rate to C 1160 bottoms).
- HS000 Do not activate HS000 until HC004 has opened to ensure that flow through F-1160 will not be interrupted. HS000 closes the valve, (LC000), and shuts off the flow to F-1160.
- HS006 HC controls the flow rate through F1100A/B. If the HC is set in the closed position, the valve will not open.
- HS068 FC068, shuts off the stripping steam to C 1160.

HS002 FC002, shuts off the stripping steam to C 1100.

HS023 MOV023 Shuts off crude feed to the unit.

The following switch is a selector in the DCS graphic.

HS043 HC043 is normally in the activated position, thereby routing C-1160 bottoms quench stream through E-1163 A and B for maximum cooling. (Maximum temperature of the residuum to C 1160 bottoms pumps, P-1165 and P-1165A, is 650°F.)

#### Switch Operation

To activate the switches, turn them. Lights are provided to indicate the position of the valves operated by the switches. Green lights indicate that the valves are in the "normal run" position. Red lights indicate that the valves are in the "emergency shutdown" position. When the switches are activated, allow time for the lights to change. Always confirm valve positions to verify that they have actually opened or closed. Do this by checking associated meters for each system and follow up with a field check as time permits.

When the emergency switches are activated, the valves (FC000, FC065, FC068, FC002) controller modes switch to manual and output is set to -6.9. To return to the "normal run" position, the switches must be rotated back to their original position first. Then they may be controlled from the DCS. The controllers will remain in manual until the PCO changes the mode. The valves that are controlled by a "HC", (HC087, HC006, HC004) travel to a preset position and then the output may be adjusted to control flow as needed. When the switches are returned to the normal position, the valves will close. The fuel gas double chopper valves, (HV003A/B, HV013A/B, HV621A/B) will close when the switches are turned. These valves have solenoids that dump the air to the valve. When the hand switches are returned to the normal position the solenoids will need to be reset (re-latched) for the valves to open. Note: Do not reset these emergency shutdown system valves until the emergency situation is corrected and the unit is ready to prepare for start-up.

#### Operation on air or Instrument Power Failure

In the event of an instrument air or instrument power failure, the valves operated by the hand switches will fail as follows:

Switch No.	Valve	Service	Action
HS001	HC003 A/B	Fuel gas to F-1100A	Closes
HS011	HC013 A/B	Fuel gas to F-1100B	Closes
HS087	HC087	7s/c to 8s/c pumpback	Opens
HS061	HC621A/B	Fuel gas to F-1160Closes	
HS065	FC065	Residuum Rundown to Offplot	Closes
HS043	HC043	Maximum Quench Cooling	Opens
HS004*	HC004	C-1160 Bottoms to F-1160	Closes
HS000*	FC000 (C000)	C-1100 Bottoms to F-1160	Locks

Switch No.	Valve	Service	Action
HS006*	HC006	C-1100 Bottoms to F-1100A and B	Closes
HS068	FC068	Stripping Steam to C-1160	Closes
HS002	FC002	Stripping Steam to C-1100	Closes

Note that all valves fail for emergency shutdown short loop circulation except as follows:

- A. HC004 (HS004) C-1160 bottoms to F-1160 closes. This valve must be manually opened.
- B. LC000 (HS000) C-1100 bottoms to F-1160 locks to hold position. This valve must be manually closed with the hand jack.
- C. HC006 (HS006) is a HC that controls the flow from C-1100 to F-1100A/B closes. This valve must be manually opened.

#### Wash Oil Flush.

The emergency bypass loops are normally stagnant. Since these three systems may contain heavy oils, it is important that they be checked periodically. For this reason, three meters, FI007, FI642, and FI641, have been provided that will allow wash oil or crude to be metered through the stagnant sections. They are as follows:

- C-1100 bottoms to F-1100A and B downstream of HC006.
- Maximum quench cooling line upstream of HC043.
- C-1160 bottoms to F-1160 downstream of HC004.

These stagnant sections must be flushed monthly on a routine basis and anytime after the system has been used.

#### Hot Oil Pump Vents

Hot oil pump vents are routed to the Vacuum Column to avoid heavy residuum or gas oil from entering and possibly plugging up the relief system.

#### Pumpout System

A pumpout system has been provided to assist the operator in the safe cleanup of hot oil pumps. Hot oil from pump cases shall never be drained to the oily or storm water drainage system.

#### Level Instrument Blow down

Level instruments are designed so that each may be blown down to the relief system.

### **3.6 Fire Protection Equipment**

This section describes the types of fire protection equipment on the unit. Plant protection personnel will handle any fire, except an incipient stage fire. Figure 3.1 shows the locations of 4 Crude Unit fire protection equipment.

There are nine types of equipment that can be used in case of a fire:

- Emergency Block Valves (EBVs)
- Motor Operated Valves (MOVs)

- Fuel Isolation Block Valves
- Fire Water Supply System
- Fire Hydrants
- Fixed Fire Monitors
- 100' Hose stations
- Hose Reels (Foam)
- Water Deluge System
- Fire Extinguishers

**Emergency Block Valves (EBVs)**

Emergency block valves (EBVs) are equipped with fusible plugs that will close the suction of the pump and additionally shut the pump off in the event of activation.

**Motor Operated Valves (MOVs)**

Motor-operated valves (MOV) have been provided on pump suction lines 14" in diameter and on those pumps that operate at 600°F or above. These were installed to assist the operator in safely securing a pump in case of fire. Remote and local "open"/"close" push buttons have been provided for this reason.

The MOV's can also be operated manually in case of a power outage.

Table 3.5-3 describes the 4 Crude Unit MOVs:

**Table 3.6-1 #4 Crude Unit MOV's**

Equipment	MOV #	Remote Location	Service
18" Crude Feed Line	MOV023	DCS Console / 11HS023	Crude Feed
P-1101A	MOV112	P.S. #7	Crude Feed
P-1101B	MOV113	P.S. #7	Crude Feed
P-1101C	MOV114	P.S. #7	Crude Feed
P-1102A	MOV009	P.S. #E1	Desalted Crude Feed
P-1102B	MOV010	P.S. #E1	Desalted Crude Feed
P-1102C	MOV011	P.S. #E1	Desalted Crude Feed
P-1148	MOV003	P.S. #14	Atmos. Bot. Circ. Reflux
P-1148A	MOV004	P.S. #14	Atmos. Bot. Circ. Reflux
P-1159	MOV005	P.S. #14	6 Sidecut
P-1159A	MOV006	P.S. #14	6 Sidecut
P-1158	MOV007	P.S. #14	5 Sidecut Pumpback
P-1158A	MOV008	P.S. #14	5 Sidecut Pumpback
P-1165	MOV021	P.S. #15	Vacuum Bottoms
P-1165A	MOV022	P.S. #15	Vacuum Bottoms
P-1178	MOV015	P.S. #7	Vacuum Overflash
P-1178A	MOV016	P.S. #7	Vacuum Overflash

Equipment	MOV #	Remote Location	Service
V-1100 / P-1100A/B/C	MOV000	P.S. #9	Atmos. Overhead Liquid

#### Fuel Isolation Block Valves

Furnace isolation valves on the fuel system are provided in addition to board-mounted emergency shutdown switches. The isolation valves are located 100 ft away from the furnaces to assist the operator in safely shutting off the furnace fuel supply in an emergency.

#### Fire Water System

The main supply line enters the Crude Unit from Petrolite and Foundation Streets. A 10-inch periphrcal line is routed along the west, south, and the east side of the plant. Another 8-inch line junctions off the 10-inch inlet line and runs parallel with Naphtha Street at the north side of the plant. This line joins the 10-inch line at the east end of the plant.

Three other supply lines connect to the system from other areas. One 10-inch line enters from the north, running parallel with Channel Street. This line supplies water from the Tide Gate fire pump, Pen Hex, and the Isomax fire pumps.

Another 10-inch line enters the system at the southwest corner of the unit near V-1102 Desalter. This line supplies water from P-12A/B fire pumps located at the Turning Basin.

The third line enters the system at the northwest corner of the plant from a 12-inch line running parallel to Hydro Street. The water supply for this section of line is from the Tide gate fire pumps and the main supply line on Petrolite Street.

These lines supply additional water during a fire or other emergencies. A total of 9300 gpm of firewater can be supplied to the area as follows:

- 2500 gpm from the main supply line
- 5000 gpm from No.2 Tide Gate pumps
- 1800 gpm from P-12 and P-12A fire pumps at the Turning Basin area.

150 psig pressure is maintained on the main supply line. If the pressure drops, the emergency fire pump located near 1498 Tank will start automatically to hold 150 psig pressure.

During a fire or other emergencies the Utilities Area Supervisor will order additional fire pumps put on line to supply the water demand.

Fire monitors, hydrants, hose reels and boxes are to be used for fire fighting and equipment cooling during a fire. They are not to be used for general washdown around the plant area.

Valves on the Crude Unit fire water line are located on all the inlet lines for sectional isolation. Isolating a section of the fire water line should be done only with Area Supervisor approval in coordination with Utilities section and Plant Protection. In case of a line break on the fire water line, notify the Area Supervisor or Southyard Area Supervisor immediately.

#### Fire Hydrants

Seven fire hydrants have been provided around the periphery of the Unit to assist in fighting large fires. Table 3.6-2 describes the locations of the fire hydrants located on the perimeter of 4 Crude Unit. See Fire Monitors and Hydrants for the refinery list.

**Table 3.6-2 #4 Crude Fire Hydrant Locations**

Northwest corner of 4 Crude Plot Limit
North of E-1164's
South of E-1102's
Southeast of K-1196
Northwest of F-1160
North of E-1148
Northwest of K-1171A

**Fixed Fire Monitors**

Seven stationary fire monitors are strategically located around the periphery of the Crude Unit. These monitors have been provided to assist in gaining quick control over a large fire. These monitors are designed so they can be turned on in a fixed position when needed and be left unattended. They were installed to provide protection for major equipment, pumps, compressors, and exchangers. The monitors can be activated quickly via an inball valve located on the DEWOP supply line to each monitor. Table 3.6-3 describes the locations of the fire monitors located on the perimeter of 4 Crude Unit.

**Table 3.6-3 #4 Crude Unit Fire Monitor Locations**

Northwest Corner of Plot Limit Manifold
South of V-1102 (in-between V-1102 and MCC)
South of C-1180 (Foam Station)
Southeast of T-1108
Southeast of C-1140 (Foam Station)
Northwest of C-1160 (Foam Station)
North of E-1115 (Foam Station)

**Hose Reel and 150' Hose Box Stations**

There are 10 150' Hose Box Stations and two Hose Reels located throughout the Crude Unit to assist the operator in fighting a fire as he first arrives on the scene. The Hose Reel and Box stations are located in parts of the plant that provide most of the normal fire fighting capacity and so that they are able to reach any part of the plant. Hose reels and Box Stations are not intended for plant washdown.

Table 3.6-4 describes the location of the Hose Reel and 150' Hose Box Stations.

**Table 3.6-4 Hose Station Locations**

Type of Equipment	Location
Foam Hose Reel	Pipe Stanchion #12
Foam Hose Reel	West of F-1100A Pass #1
150' Hose Box	South of V-1102
150' Hose Box	South of C-1180

Type of Equipment	Location
150' Hose Box	South of P-1139
150' Hose Box	Southeast of C-1140
150' Hose Box	Northwest of C-1160
150' Hose Box	Northeast of K-1100B
150' Hose Box	Pipe Stanchion #1
150' Hose Box	Pipe Stanchion #6
150' Hose Box	Pipe Stanchion #9
150' Hose Box	Pipe Stanchion #G1

#### Water Deluge System

A Deluge system has been provided for hot oil pumps operating at 600°F and above. The Deluge system additionally provides cooling for V-1100 (Atmospheric Reflux Drum) & V-1190 (C-1190 Overhead Liquid). The Deluge system is supplied by DEWOP water which operates at approximately 150 psig. The Deluge system provides a high volume of cooling water to covered equipment. The Deluge system is additionally equipped with a fresh water supply source for flushing out the system after each use. The system is equipped with a drain line at the end of each covered area so that the system can be drained after each use. The Deluge system can be activated in one of two ways;

- Fusible plug melting allowing air pressure to bleed off of system activating the inball valve for that location. The fusible plugs are located at the various locations directly above the pump seals.
- Remote activation via handswitch at Deluge control panel next to K-1100B. Turning the handswitch also bleeds the air pressure off of the system allowing the inball valve to open.

Table 3.6-5 describes the equipment associated with each area of the deluge system.

**Table 3.6-5 Deluge System Locations**

Area 1	P-1101A/B/C & P-1178/A
Area 2	P-1165/A & P-1188/A
Area 3	P-1148/A, P-1190/A, P-1195/A & V-1190
Area 4	P-1100A/B/C & V-1100
Area 5	P-1105/A, P-1128/A, P-1158/A & P-1159/A
Area 6	P-1102A/B/C
Area 7	P-1119, P-1129/A, P-1139, P-1149/A

The Deluge system is to be turned on should a severe packing leak develop. If immediate cooling/quenching is not provided, the hot hydrocarbon liquid could flash and cause a fire.

### Fire Extinguishers

There are 34 Fire extinguishers in #4 Crude Unit. Of those, 25 are Dry chemical and 9 are Carbon Dioxide (CO<sub>2</sub>).

30 lb. Dry Chemical extinguishers are located throughout the Crude Unit to assist in fighting Class B & C fires.

CO<sub>2</sub> extinguishers have been provided to extinguish electrical fires around switchgear, motor breakers and the fin fan deck. CO<sub>2</sub> extinguishers are used for fighting Class B & C fires.

- Class A Fire: Those fires which involve ordinary combustible materials such as wood, cloth, paper, rubber, and many plastics.
- Class B Fire: Those fires, which involve flammable and combustible liquids and gases.
- Class C Fire: Those fires, involving energized electrical equipment.
- Class D Fire: Those fires which involve combustible metals such as aluminum, magnesium, titanium, zirconium, sodium, and potassium.

**Table 3.6-6 Fire Extinguisher Locations**

Location	ID Number	Type	Use
Southeast of F-1160	3-H-01	30 lb. Dry Chemical	Type B & C Fires
1&2 Sidecut Analyzer Shack	3-H-02	30 lb. Dry Chemical	Type B & C Fires
Southeast of F-1100B	3-H-03	30 lb. Dry Chemical	Type B & C Fires
Pipe Stanchion 14	3-H-10	30 lb. Dry Chemical	Type B & C Fires
Pipe Stanchion 18	3-H-11	30 lb. Dry Chemical	Type B & C Fires
Pipe Stanchion 19	3-H-14	30 lb. Dry Chemical	Type B & C Fires
Pipe Stanchion 12	3-H-16	30 lb. Dry Chemical	Type B & C Fires
Pipe Stanchion 8	3-H-20	30 lb. Dry Chemical	Type B & C Fires
East of K-1100A/B	3-H-22	30 lb. Dry Chemical	Type B & C Fires
South of Plot Limit Manifold	3-H-27	30 lb. Dry Chemical	Type B & C Fires
North of Plot Limit Manifold	3-H-28	30 lb. Dry Chemical	Type B & C Fires
Southwest of Motor Control Center	3-H-32	Carbon Dioxide	Type B & C Fires
Southeast of Motor Control Center	3-H-33	Carbon Dioxide	Type B & C Fires
West Door of MCC (Outside)	3-H-34	Carbon Dioxide	Type B & C Fires
West Door of MCC (Inside)	3-H-35	Carbon Dioxide	Type B & C Fires
East Door of MCC (Inside)	3-H-36	Carbon Dioxide	Type B & C Fires
East Door of MCC (Outside)	3-H-37	Carbon Dioxide	Type B & C Fires
Pipe Stanchion E2	3-H-41	30 lb. Dry Chemical	Type B & C Fires
P-1102A	3-H-43	30 lb. Dry Chemical	Type B & C Fires
Pipe Stanchion E1	3-H-44	30 lb. Dry Chemical	Type B & C Fires
1 <sup>st</sup> Deck of V-1100 Structure	3-H-45	30 lb. Dry Chemical	Type B & C Fires

Location	ID Number	Type	Use
2 <sup>nd</sup> Deck of V-1100 Structure	3-H-46	30 lb. Dry Chemical	Type B & C Fires
3 <sup>rd</sup> Deck of V-1100 Structure	3-H-47	30 lb. Dry Chemical	Type B & C Fires
4 <sup>th</sup> Deck of V-1100 Structure	3-H-48	30 lb. Dry Chemical	Type B & C Fires
5 <sup>th</sup> Deck of V-1100 Structure	3-H-49	30 lb. Dry Chemical	Type B & C Fires
Fin Fan Deck at E-1100A2	3-H-50	Carbon Dioxide	Type B & C Fires
Fin Fan Deck at E-1190A2	3-H-51	Carbon Dioxide	Type B & C Fires
Fin Fan Deck at E-1149-2	3-H-52	Carbon Dioxide	Type B & C Fires
2 <sup>nd</sup> Deck of V-1160 Structure	3-H-53	30 lb. Dry Chemical	Type B & C Fires
Pipe Stanchion 15	3-H-71	30 lb. Dry Chemical	Type B & C Fires
Pipe Stanchion 10	3-H-72	30 lb. Dry Chemical	Type B & C Fires
Southwest of E-1163's	3-H-74	30 lb. Dry Chemical	Type B & C Fires
P-1139	3-H-75	30 lb. Dry Chemical	Type B & C Fires
Southeast of F-1100A	3-H-78	30 lb. Dry Chemical	Type B & C Fires

### 3.7 Failure Prevention

Failure Prevention can be achieved through a combination of good design and good operating practices. The following major concerns exist:

- Brittle fracture
- Stress corrosion cracking
- Wet H<sub>2</sub>S cracking
- Naphthenic acid corrosion
- Sour water corrosion
- External corrosion
- Overhead hydrochloric acid corrosion
- Chloride stress corrosion cracking
- Cooling water corrosion
- Salt corrosion and fouling

The above major concerns can be protected against through a series of preventative measures. The following list some of the preventative measures taken in the #4 Crude Unit.

- Correct metallurgy
- Correct operation of Desalter, including Desalter chemical injection
- Capability of Ammonia injection to neutralize HCl
- Caustic injection to neutralize chlorides in atmospheric overhead
- Scheduled inspections

### 3.8 Reference Drawings For This Section

#### 1. Drawings

#4 Crude Pump Water Deluge System	D-330514
#4 Crude Pump Water Deluge System	<u>D-330515</u>
#4 Crude Pump Water Deluge System	<u>D-330516</u>
#4 Crude Fire Water System Off-Plot Distribution	<u>D-329006</u>

### Revision Record

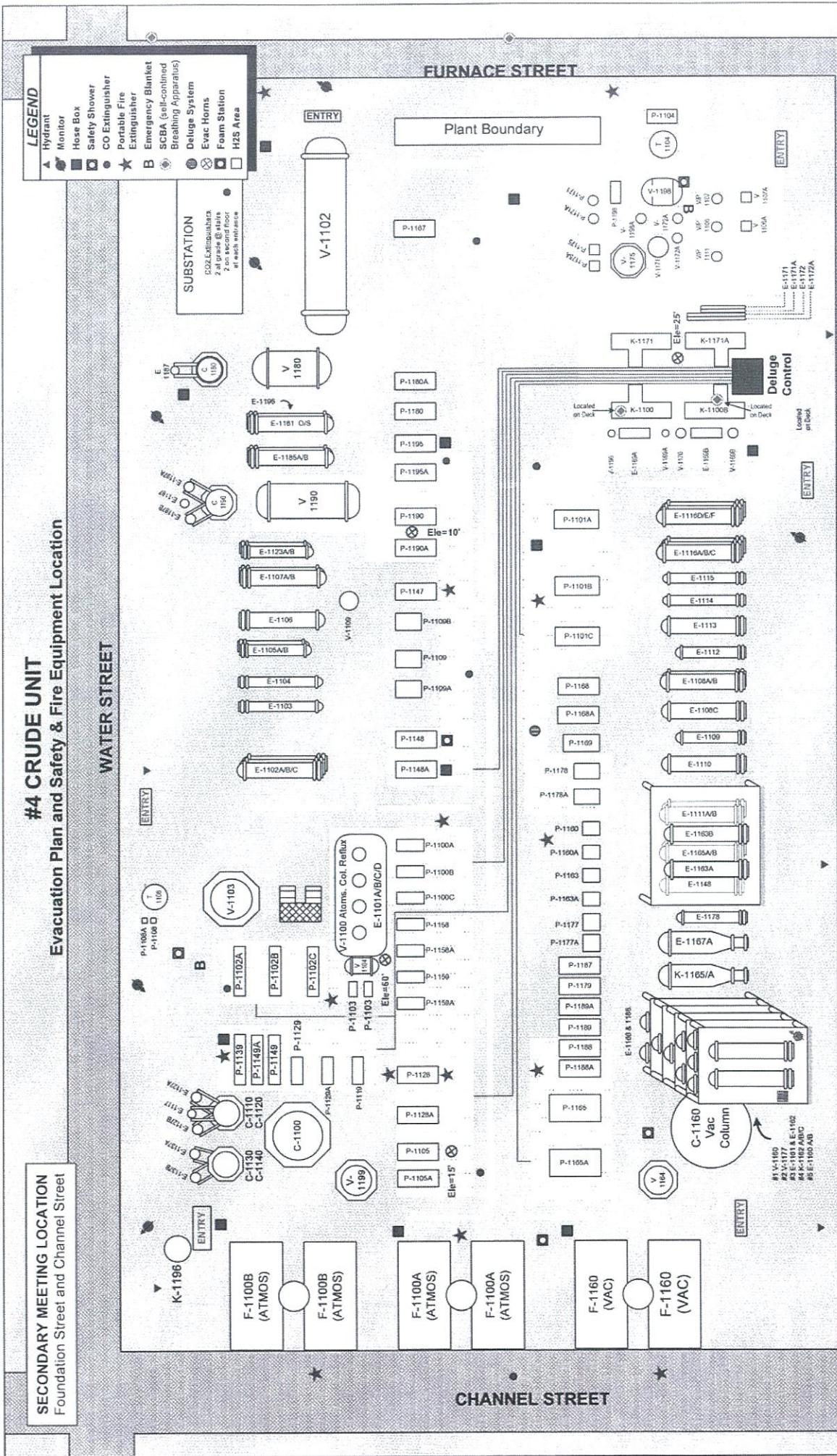
Date	Step	MOC#	Comments
05/06/02		200-00-004	EOM conversion.
09/03/02	Table 3.5-2	9094	Added "P-1165 Suction" and "P-1165A Suction" to table.
5/15/03	3.5	9094	EBV Section - Added item to bulleted list "You will need to manually..."
5/20/03			SME Review
5/22/03	Table 3.4-2	11725	Updated table for new SCBA's on K-1100 decks
11/17/2006	3.3	RI-313	Recent changes to this refinery instruction dictates refinery wide change to Volume 1, Chapter 3-Safety, EOM content for MSDS, chemical inventory and Hazardous Materials Business Plans. RI-313 is the single source reference. Manuals & Procedures/godd
3/10/08	3.5	PSM/CalARP	Added FSC information.
8-17-08	All	PSM	Repaired broken links for: <ul style="list-style-type: none"><li>• Hazard Communication Standard and Chemical Inventory Process</li><li>• MSDS</li><li>• Pressure Relief devices</li><li>• Fire Monitors and Hydrants</li><li>• Chemical Inventory Reports</li><li>• Radiation Information</li></ul>

## **#4 CRUDE UNIT**

### **Evacuation Plan and Safety & Fire Equipment**

Evacuation Plan and Safety & Fire Equipment Location

**SECONDARY MEETING LOCATION**  
Foundation Street and Channel Street



**Figure 3-1**

DOING BUSINESS SIMPLY Rev. 4 - 05/23/03 1C1PES3-1.vsd

**PRIMARY MEETING LOCATION  
LSFO Control House**

### 3. Safety Information

This chapter familiarizes the operator with the safety hazards associated with the Debru Unit. This chapter is divided into the following section:

- Responsibilities
- Process Safety management (PSM) Overview
- Potential Unit Hazards
- Personnel Safety Issues
- Unit Safety Systems and Devices
- Fire Protection Equipment
- Failure Prevention

#### 3.1 Responsibilities

Safety is the most important concern for every Chevron employee. Management has the legal responsibility to provide a safe workplace. However, safety is everyone's responsibility. Safety rules exist for the following three reasons:

- Personal safety and protection
- Safety of fellow employees
- Protection of equipment and facilities

All employees are responsible:

- To be aware of potential hazards within the unit
- To know unit normal and emergency operations and procedures
- To adhere to Chevron safety policies and procedures
- For the safety of all people that enter their work areas
- To know the location and proper use of all safety equipment on the unit

Failure to comply with all safety rules can result in disciplinary action, up to and including dismissal. This policy is designed for the protection of all employees.

Refer to the following for additional information about safety:

- Safe Work Procedures
- Safe Lock-Out and Tag-Out Procedure (R-9900)
- Unit Procedures Manual (UPM)
- Process Safety Management Manual (PSM)
- Hazards Communications Manual (HAZCOM)
- Unit Process Hazards Analysis (PHA)
- Material Safety Data Sheets (MSDS) for products on the unit

### 3.2 Process Safety Management (PSM) Overview

On May 26, 1992, the Occupational Safety and Health Administration (OSHA) enacted legislation addressing management of the hazards associated with storage and use of chemicals in the work place. This legislation, 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals, referred to as PSM, addresses 14 elements covering process design, operation, and maintenance. It applies to industries that store or use designated chemicals in quantities that potentially can be the source of catastrophic events such as fires, explosions and toxic releases. The 14 elements of the PSM regulation cover the following areas:

- Employee Participation - involves employees in developing PSM.
- Process Safety Information - defines process chemicals, technology, and equipment.
- Process Hazard Analysis - evaluates potential hazards.
- Operating Procedures - documents steps to operate the process safely.
- Training - ensures operators understand process hazards and how to safely operate the process.
- Contractors - ensures contractors operate safely and understand process hazards.
- Pre-Startup Safety Review - ensures new and modified processes are safe to operate.
- Mechanical Integrity - ensures equipment reliability.
- Hot Work Permits (RI-341) - establishes controls for potential fire sources.
- Management of Change (RI-370) - establishes controls for changing the process or its information.
- Incident Investigation (RI-371) - ensures incidents and near misses are investigated promptly and recommendations are implemented.
- Emergency Planning and Response (RI-400/RI-480)' - establishes a plan and management for responding to emergencies.
- Compliance Audits - ensures programs are being used.
- Trade Secrets - makes all necessary information available.

### 3.3 Potential Unit Hazards

#### Chemical Inventory Specific Work Locations and Master MSDS & HMBP Book Locations

RI-313 - Hazard Communication Standard and Chemical Inventory Process is the single source reference for Chemical Inventory in the Richmond Refinery. Appendix 1 of this standard details the location for authorized official hard-copy binders for chemical inventory and Hazardous Materials Business Plans.

This section describes the potential hazards at the Debru Unit. It is divided into the following four sections:

- Potential Unit Hazards
- Hazardous Samples
- Material Safety Data Sheets
- Chemical Inventory List

**Potential Unit Hazards**

Many Potential Unit Hazards are present everyday in a refinery environment. These hazards, in the form of chemicals, gases, etc. are necessary in the Debru Unit operating processes.

Operating personnel must identify those plant hazards, so that they may safely handle and work with them.

Table 3.3-1 Potential Unit Hazards, identifies the names and possible locations of hazardous materials at the Debru:

**Table 3.3-1 Potential Unit Hazards**

Hazard	Location and Effect	First Aid
Hydrogen Sulfide (H <sub>2</sub> S) MSDS #301	<p>H<sub>2</sub>S is a colorless gas slightly heavier than air. It is easily identified in very low concentrations (0.13 ppm) by the strong, pungent odor of rotten eggs. H<sub>2</sub>S is both an irritant and an asphyxiant. H<sub>2</sub>S is extremely poisonous, and breathing any concentration must be avoided.</p> <p>Concentrations from 10 ppm for 8 hr. TWA cause irritation of the eyes; slightly higher concentrations may cause irritation of the upper respiratory tract. With higher concentrations, the action of the gas on the nervous system becomes more prominent. At concentrations over 100 ppm, hydrogen sulfide paralyzes the smelling senses and, thus the odor is not a dependable indicator of the presence of H<sub>2</sub>S.</p>	Move affected person to safety-shower / eyewash station. Flush with water for 15 minutes. Call CFD for emergency medical response. During emergency response wear SCBA. If ingested do not induce vomiting. Remove and discard contaminated clothing.
Benzene MSDS #10101	<p>The oil streams in 3144/3126 Tank and the DEBRU equipment can contain over 0.1% benzene, this means that these streams fall under the OSHA guidelines on benzene exposure. Any work that involves exposure to the oil, water or vapor must be done in an approved respirator and rubber gloves.</p> <p>Carcinogenic. Inhalation hazard. Avoid contact with skin, eyes, and clothing.</p> <p>When any of this equipment is going to be turned over to maintenance it must be flushed to reduce the chance of exposure. If any work is to be done in an enclosed space a drager sample for benzene must be taken to insure that the airborne concentration is below 1ppm. If there is a chance that any sludge or residue with a benzene concentration over 0.1% will get on workers clothing, they must wear chemical resistant clothing. The Safety Section will periodically want to monitor work around this equipment to insure that exposures are below a time weighted average of 1 ppm for 8 hours.</p>	Move affected person to safety-shower / eyewash station. Flush with water for 15 minutes. Call CFD for emergency medical response. If ingested do not induce vomiting. Remove and discard contaminated clothing.
Pyrophoric Iron Sulfide	H <sub>2</sub> S will combine with iron to form pyrophoric iron sulfide. Upon exposure to air, this compound will self-ignite and produce sufficient heat in some cases to ignite any gas present. This hazard can be prevented by keeping the material wet until it is free of gas.	

Opening Equipment	When opening equipment, be sure that the equipment has been thoroughly washed or steamed and is free of H <sub>2</sub> S as indicated by a Drager hydrogen sulfide detector. On the initial opening of any line or vessel, fresh air breathing equipment must be worn until such opening is made and equipment is indicated safe by a Drager hydrogen sulfide detector.	
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**Hazardous Samples**

Because of the benzene and H<sub>2</sub>S, special designs have been incorporated to make such routine operations as sampling and removing instruments for repair safe.

Table 3.3-2 identifies the most hazardous samplings in the Debru Unit. These are:

- Sour Samples
- Instrument Flush
- Mechanical Seal Flush

Any sampling can be hazardous if taken improperly.

**Table 3.3-2 Hazardous Samples**

Sample	Hazard
Sour Samples	Sample stations for sour materials are designed to minimize the exposure to H <sub>2</sub> S and benzene. All samples will be taken in a balloon or bottle. Sample stations provide for circulating the sour sample back to the process or to a closed drain to get a representative sample.
Instrument Flush	Instruments in sour service are designed so that each may be thoroughly flushed before removal for maintenance
Mechanical Seal Flush	Pumps in sour service have an external sweet flush system to eliminate sour stock escaping to the atmosphere during normal operation and to extend seal life.

**Material Safety Data Sheets (MSDS)**

Material Safety Data Sheets (**MSDS**) proved critical information for all potentially hazardous chemicals present in the Debru Unit. MSDSs are in the LSFO Control Center. The MSDS for each chemical provides information on:

- Trade names
- Hazardous ingredients
- Physical and chemical characteristics
- Fire and explosion hazard data
- Known acute and chronic health effects and related health information
- Exposure limits
- Spill or leak procedures
- Personal protective equipment requirements

- Special precautions for handling or using hazardous chemicals
- Whom to contact for further details

#### Chemical inventory list

The Richmond Refinery maintains a facility-wide Chemical Inventory System to support the OSHA Hazard Communication Standard and Hazardous Materials Planning needs. Refer to the Refinery Chemical Inventory Reports for the most current list.

### 3.4 Personnel Safety Issues

This section describes some of the protective measures that personnel in the Debru Unit need to take to ensure their safety and the safety of others. This section is divided into:

- Color Coding of Lines and Valves
- General Safety Rules
- Personal Safety Equipment
- Visitors

#### Color Coding

Color Coding designates certain hazards in the Debru Unit. Color coding, done in accordance with RI-302, is divided into the following categories:

- Color Coding of Lines
- Color Coding of Valves

Table 3.4-1, **Color Coding of Lines**, identifies specific colors and associated types of special purpose equipment.

**Table 3.4-1 Color Coding of Line**

Color (Lettering on Background)	Equipment/Lines
Black on White	LPG
Black on Aluminum	Ammonia
Black on Cream	Drinking, Cooling, and Utility Water
Yellow on Blue	Nitrogen/CO <sub>2</sub> /Other Inerts
Black on Blue	Steam, Condensate, and Boiler Feed Water
Red on Blue	Utility and Instrument Air
White on Green	Gasoline, Jets, Naphthas, Thinners, and Solvents
Yellow on Green	Natural Gas and Sweet Fuel Gas
Red on Green	Hydrogen
White on Black	Gas Oils, cycle Oils, Crude Oils, Diesels, and Heavy Oils
Black on Yellow	Toxic or Corrosive Chemicals, Additives, Acid, Caustic,

Color (Lettering on Background)	Equipment/Lines
	Sour Stocks/Streams
White on Read	Fire Water Lines
Black (entire line is black)	Fire Foam Systems
White on Orange	Environmental (recovered oil)
Black on Yellow (entire line is yellow)	Lines containing pure H <sub>2</sub> S
White on purple	Reclaimed Water Lines
Fluorescent Green spray/brush	Dismantling Pipes/Equipment
White on Blue	Non asbestos-Containing Material

### General Safety Rules

The General Safety Rules are designed to help personnel prevent accidents and properly treat injuries. Specific safety rules may be added to these general rules as conditions require. All employees must comply with these rules.

### Personal Safety Equipment

This section describes personal safety equipment and emergency safety equipment on the Debru Unit. Personal safety equipment includes:

- Protective clothing
- Respiratory equipment
- Safety Shower/Eye Wash Stations
- Operators must know the location and use of all safety equipment on the unit.

#### **Protective Clothing**

The following list identifies required equipment:

- Hard hats
- Safety glasses
- Sturdy leather shoes or boots with notched heals
- Nomex coveralls

The following items are required, based on particular personnel actions:

- Safety gloves
- Chemical-resistant gloves
- Leather gloves and clothing
- Acid suits
- Chemical boots
- Chemical goggles
- Welding goggles
- Face shields

**Respiratory Equipment.** Scott Air Paks are used for any emergency requiring the use of fresh air.

<b>Table 3.4-2 Scott Air Pak Locations</b>	
#0182	NE of D-3110
#0186	SW of Calgon Vessel #1
#0115	SW of 3126 Tank

### Safety Showers and Eyewashes

Safety Shower/Eye Wash stations are provided in case of accidental exposure to process chemicals. The purpose of the safety shower and eye wash is to provide an immediate water flush for the body or eyes. Neither the safety shower or eye wash should take the place of additional first aid that may be required.

<b>Table 3.4-3 Safety Showers and Eyewash Locations</b>	
NE of Calgon Vessel #6	

### Visitors

Personnel wanting to enter the unit will contact the head Operator or Process Control Operator, before working on equipment or visiting any part of the plant. All personnel, not assigned to operating the unit, will be required to follow the sign in procedure as specified in RI-375. All visitors will be required to wear hard hats, safety glasses, long sleeves and substantial leather shoes. Refinery policy requires that all visitors wear Nomex coveralls if going into an operating unit.

## 3.5 Unit Safety Systems and Devices

### Plant Layout

The plant was laid out in accordance with the latest Company standards, with particular emphasis on access, isle width, head room, hazardous area location, fire handling, lighting, and electrical classification.

### Earthquake

It was designed according to Recommended Practice 11, "Wind and Earthquake Design Standards" (November 1972) for Earthquake Zone 3, Seismic Zone Factor Z-1.0, and Wind Zone 20.

### Fire

The fire-fighting system consists of fire monitors and hydrants on the periphery of the plant, and are supplied with high pressure DWOP water from the refinery fire system. If the system pressure drops salt water makes up the difference.

### Radio System

The LSFO complex utilizes one of the most sophisticated radio systems available today, the Motorola STX system. The STX system allows netting with up to 59 different talk groups in

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the refinery with the Head Operators and Shift Team Leaders radios and communication on several channels on the operators' radios. This system was designed to allow fast direct communication under normal conditions. The STX also has a special safety feature that allows quick communication directly to Plant Protection by pushing the orange button. During an emergency such as an injury or fire, the radios designated identification number is automatically recorded and a direct channel opened to the Plant Protection dispatcher. This helps identify the emergency location and is especially helpful if the user is unable to talk.

#### **Low Noise Level**

The plant was designed to the latest Company noise standard of 85 dBA maximum for any one piece of equipment and an accumulative maximum plant noise level of 90 dBA. This was achieved by careful selection of control valves and quiet motors.

#### **Pressure Relief Devices**

Pressure Relief Devices (PRDs) protect equipment from damage by excessive pressure or vacuum inside it. See the HES web site for Refinery list by plant: [Pressure Relief Devices](#).

### **3.6 Fire Protection Equipment**

This section describes the types of fire protection equipment on the unit. Any fire, except an incipient stage fire, will be handled by Chevron Fire Department personnel. For Refinery Wide lists see: [Fire Monitors and Hydrants](#)

There are five types of equipment used in case of a fire:

- Emergency Block Valves (EBVs)
- Fire Hydrants
- Fixed Fire Monitors
- Hose Reels
- Fire Extinguishers

#### **Emergency Block Valves (EBVs)**

Emergency Block Valves (EBVs) provided at the pump suction and/or discharge enable operators to quickly isolate a pump if the packing or seal starts to leak badly. These valves have a low-temperature link tied into the instrument air signal for the associated EBV. A fire will melt the link and the valve will close.

The check valve serves as a block on the discharge, in most cases, until the discharge valve can be closed.

**Table 3.6-1 EBV Locations**

EBV Location	EBV Number	Local Switch Location
N/A		

Fire Hydrants

A Fire Hydrant is located 50' S of P-3400A. See Refinery list for Fire Monitors and Hydrants.

Hose Reel and Hose Box Stations

Hose Reels and Hose Boxes are located in parts of the plant that provide the normal fire fighting capacity and so that they are able to reach any part of the plant. Hose Reels and Hose Boxes are not intended for plant wash down. They are inspected on a monthly basis.

**Table 3.6-2 Hose Reel and Hose Box Locations**

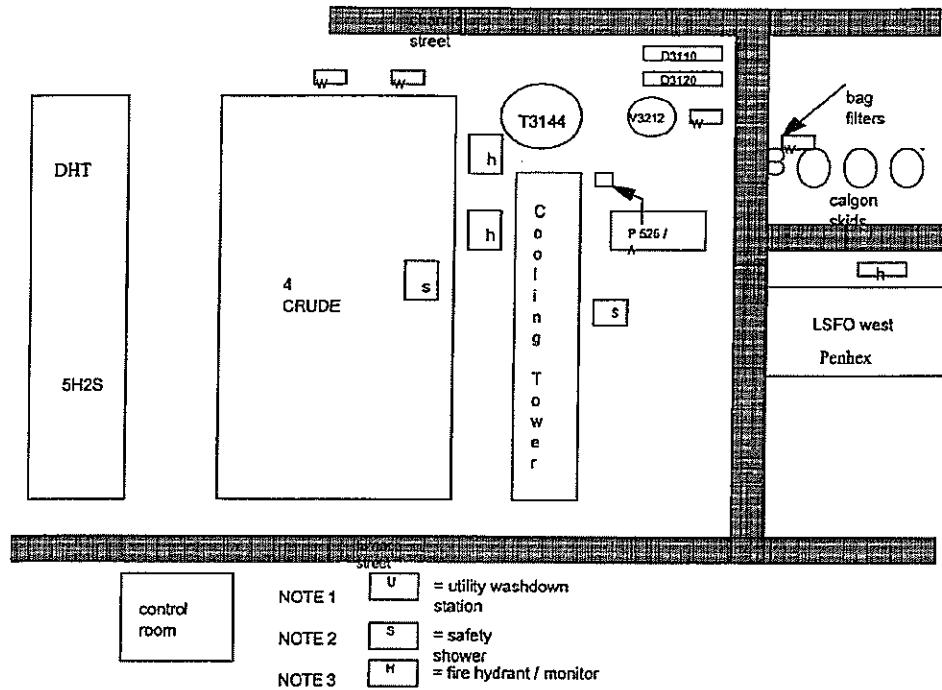
SW of 3126 Tank
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Fire Extinguishers

Fire Extinguishers are used on electrical fires and can be used on other small fires not requiring the use of fire hoses.

**Table 3.6-3 Fire Extinguisher Locations**

Equipment	Location
3-H-66	W of V-3212



Simplified plot plan  
of LSFO EAST plants and  
safety  
equipment supporting  
DEBRU

## Revision Record

Date	Step #	MOC#	Comments
3/29/01	Tbl. 3.3-1 Benzene	200-00-004	Added /3126 after 3144
10/13/03		11275	MOC Route Seal Flush Water to P-84 and P-642
11-17-2006		CAL ARP	Removed "UNOFFICIAL COPY" watermark
	3.3	RI-313	Recent changes to this refinery instruction dictates refinery wide change to Volume 1, Chapter 3-Safety, EOM content for MSDS, chemical inventory and Hazardous Materials Business Plans. RI-313 is the single source reference. Manuals & Procedures/godd
5/07/07	All		SME review for content.
8-17-08	All	PSM	Repaired broken links for: <ul style="list-style-type: none"><li>• Hazard Communication Standard and Chemical Inventory Process</li><li>• MSDS</li><li>• Pressure Relief devices</li><li>• Fire Monitors and Hydrants</li><li>• Chemical Inventory Reports</li></ul>
1/22/09		35	Replaced Shift Supervisor with Shift Team Leader.

No. & Crude Unit	DAR Division	PROCESS EQUIPMENT VARIABLE	DESCRIPTION	NORMAL RANGE	LOWER LIMIT	UPPER LIMIT	CONSEQUENCE OF DEVIATION		CORRECTIVE ACTION
							PROBABLE CAUSE	PROBABLE EFFECT	
FEED: Feed Pump W6061									
111001A/B/C	PRIM FEED:	Honeywell "11AIPS" card and Alarm Detail Screen.	FLA=276 Amps	282 Amps	N/A	FLA=102 Amps	Reduced motor life from high heat caused by high amps. If pump amps rise too high, pump can trip resulting in loss of flow.	High flow through pump.	Lower flow through pump until the amps drop below alarm point. Cut feed if necessary.
111002A/B/C	SEC FEED:	Alarm set at 2% above Motor Full Load Amp Rating	FLA=128 Amps	104 Amps	FLA=128 Amps	FLA=179 Amps	132 Amps	183 Amps	
111005/A	ATM BTM: MP-1105/A	#1 SC: MP-1119	ATCR: MP-1128/A	#2 SC: MP-1129	#1 & #2 SC: MP-1129A	#3 & #4 SC: MP-1139	FLA=219 Amps	225 Amps	
111019							FLA=168 Amps	174 Amps	
111028							FLA=225 Amps	230 Amps	
111029A							FLA= 57 Amps	60 Amps	
111029							FLA= 57 Amps	60 Amps	
111039							FLA=138 Amps	141 Amps	
111048/A	ABCR/MP-1148/A	#4 SC: MP-1148					FLA= 159 Amps	163 Amps	
111049		#3 & #4 SC: MP-1148A					No readings	No readings	
111059A		#5 & #6 SC: MP-1169/A					No readings	No readings	
111059/A	In Gsic service, 13.7 MPD, Motor horsepower is the limit.	Discharge pressure at this point will be 308 psig (based on 23 psig suction)					FLA=218 Amps	225 Amps	
111065	VAC BTN: MP-1165	Limit is approx 135 MPD	#6 SC: MP-1169				FLA= 133 Amps	135 Amps	
	WFCR: MP-1168/A						FLA=213 Amps	218 Amps	
	Limit is approx 135 MPD								
111079	#7 SC: MP-1179								
111088/A	VBCR: MP-1188/A	Max amps reached at 55MPD	#5 SC: MP-1188						
111089									
111089/A	#7 & #8 SC MP-1189/A	Instrument Air Compressor	Out of service.	N/A	N/A	N/A	N/A	N/A	
MK-3200									

No. 4 Crude Unit	D&R Division	PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS	NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DERIVATION	PROBABLE CAUSE	Consequence of Deviation		CORRECTIVE ACTION
										FEED	PRODUCT	
11PCT00	Crude Feed Booster Pumps.	High Suction Pressure.	Maintain above minimum suction pressure to P-1101's.	N/A	Possible seal damage to Pumps.	Improper set point on pressure controller.	Adjust booster pump pressure controller set point to lower suction pressure.					
11PCT01		Low Suction Pressure.	N/A	25 PSIG.	Cavitation of P-1101's.	Low Feed tank level.	Adjust booster pump pressure controller set point to raise suction pressure.					
11PCT02						Improper set point on pressure controller.						
11P1050		Less than 10% of flow through pump.	N/A	<10% Flow	Possible booster pump damage.	Improper set point on pressure controller.	Adjust FC set point to satisfy minimum flow requirements.					
1108ZC701	P-4701	Speed control.	75%—90%	60%	VSD power usage not optimum.	N/A	Maximize optimizer output to 80%. May vary depending on crude slate.					
1108ZC702	P-4702	Speed control.										
1108SC702A	P-4701	Speed override.	Variable.		Minimum pump RPM has been reached.	N/A	Optimizer will adjust Valve to compensate for low rate.					
1108SC702B	P-4702	Speed override.	N/A	28 – 38 gravity.	N/A	May cause upset when changing feed composition.	Cut feed.					
						Change of crude composition.	Bring unit to a safe condition.					
						Incorrect feed specification.	Adjust draw rates and refluxes to compensate for the change in composition.					
						Excessive water in the feed stream.						
P-1101	Crude Feed Pump.	Suction pressure	40-45 PSIG	55 PSIG	N/A	Primary feed train pressure gets too high	Crude feed switch to a fresh tank.	Check P-1101s APS.				
			N/A	N/A	15 PSIG	Cavitation of P-1100's.	Booster pump pressure controller fails.	Contact B&S operator to check booster pump and pressure control valve.				
						Loss of crude flow through the primary feed train..	Loss of P-4700 Booster Pump.	Check P-1100s APS.				
							Loss of feed tank	Reduce feed rates.				
							APS starts up on spare pump.	Contact B&S operator to check booster pump and pressure control valve.				
							Booster pump pressure controller fails.	If able, restart pump.				
							Loss of a pump.	Adjust pump discharge valves to maintain control of train pressure.				
								Adjust crude feed rates to compensate for a pressure drop.				
								Adjust P-1101 discharge valves.				
								Adjust P-1101 discharge valves.				
11P1052	Crude Feed Pressure E-1102.	N/A	500—510 PSIG	550 PSIG	N/A	Possible train or exchanger damage.	Improper adjustment on P-1101 discharge valves.	One HC must be fully open at all times.				
			N/A	480—500 PSIG		Possible flashing of tight ends in primary train.	Improper adjustment on P-1101 discharge valves.	Improper adjustment of HC.				
						Possible exchanger damage.		One HC must be fully open at all times.				
						Unstable flow control.		Re-adjust HC to proper setting.				
11HC531	Primary Exchanger Train HCs	N/A	One HC fully open.	N/A	Over pressure primary feed train, lift safeties.	One HC must be fully open at all times.						
11HC532			One HC partially open to optimize heat recovery.		Cause damage to E-1101 bellow.	Improper adjustment of HC.						
V-1102	Desalter	Temperature Control	305—310°F.	320°F	N/A	Possible damage to the Teflon transformer bushings.	One HC must be fully open at all times.	Re-adjust the crude flow through the train with the primary HCs.				
				N/A	285°F	Improper heat recovery through the primary train.	Improper adjustment of HC.					

Consequence of Deviation						
No. 4 Crude Unit	DAR Division	Normal Range	Upper Limit	Consequence of Deviation	PROBABLE CAUSE	CORRECTIVE ACTION
PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS				
V-1102 DESALTER	Desalter temperature.	N/A	305-310°F.	320°F	N/A	High—Damage to Teflon transformer bushings. Low—Poor separation.
11PC051	Desalter Pressurs.	N/A	180-210 PSIG.	210 PSIG	100 PSIG	Inefficient primary train heat recovery. Imbalance of primary heat train. Excessive carry under.
11LC052	Desalter interface level controller.	Excessive carry under	0% oil in water.	Trace	0%	Desalter pressure control valve fails open. Possible vapor space develops in Desalter. Slave valve V-1103 Flashing in Desalter. Desalter temperature is too low. Chemical injection rate is low or pump has failed. Crude slate is too heavy. Level is too low; indication has failed. Problem with transformer or grid.
11FC055	Desalter low pressure water injection.	N/A	250—300 GPM.	350 GPM	N/A	Water carry over, sudden rate changes, foaming and/or swelling in Flash Drum.
11LSL01	Vapor space shutdown	Will shut off Desalter grids	Liquid Full	N/A	180 GPM	Poor Desaltering. • Possible explosion if 11LSL501 fails to shut off power to the grids. • Loss of Desalter grids • Loss of feed to V-1103. • Loss of feed to F-1100A/B. • Increasing crude unit upset.
11LC052	Desalter interface Level Controller	N/A	21-51-Inches.	51-inches	21-inches.	Low oil carry under High—water carry over, shorting transformer grids. Excessive emulsion and cuff.
C-1160 and DEBRU located in DEBRU COD Table						
11LC050	C-1160 Level	N/A	50%	80%	20%	Loss of P-1160 pumps. Water level too low.
11HW0132	Furnace chopper valve.	Valve position 11-ZL0132 open	100%	100%	Debru is non-operational.	Check level controller and restart pumps. Re-set and open chopper valve. (11-HV-0132).
V1 thru V6 PDT-013	Carbon Filters.	Two in service at a time.	N/A	High (30 psig)	N/A	Loss of benzene flow from Debru to furnaces. Carbon Filters plugging.
K-3140AB PDT-016	Bag Filters.	One in service at a time.	N/A	High (15 psig)	N/A	Low flow through the skid and a back up at Debru. Bag Filters over pressure, causing the filter bypass to chop. Bypassing the filter.
						Switch to fresh Bag Filter and change out the plugged filter.

No. & Crude Unit	PROCESS EQUIPMENT VARIABLE AND DESCRIPTION	COMMENTS	DAR Division	NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DEVIATION	PROBABLE CAUSE	CORRECTIVE ACTION	Consequence of Deviation	
										Consequence	Corrective Action
V-103 FLASH DRUM	Overhead of V-1103.	Controlled by Desalter Temperature.	280°F	340°F	270°F	Low = More load on F-1100A/B. High = Foaming. Loss of suction on P-1102's.	Low = Low primary train heat recovery (Do not overhead V-1102). Water carryover from V-1102.	Overhead V-1102 interface level.	Open primary train heat recovery (Do not overhead V-1102).	Overhead V-1102 interface level.	
11LC054	V-1103 Level	111L055	40-60%	70%	40%	77 in.	• Low = loss of suction to P-1102's (Secondary Feed Pumps) • Foaming in V-1103 and loss of suction to V-1102's. • High = carry crude directly into C-100 Flash Zone quenching temperature. • Loss of flow to F-1100A/B.	High Level • Drastic changes to lighter feed composition. • Level control valve not operating properly. • Pressure controller set too high. • Spare pump APS comes on line. • Loss of any P-1102's. • Control valve fails open.	• Check feed gravity. • Check level control valve, operate on manual if needed. • Note: Opening V-1103 level controller will have immediate effect on V-1102 level. • Put P-1102 back on line. • Bypass control valve.	High Level • Re-establish level. • Correct 11PC051 operation. • Reduce feed to atmospheric furnaces. • Pinch down on P-1102's discharge valves.	
11PC058	V-1103 pressure.	11-P-058	15-30 PSIG	60PSIG	20PSIG	Low = loss suction on Secondary feed pumps. Foaming. High = more load on F-1100A/B. If safety valve.	11-PC-059 not set at right pressure or failure of valve. Changes in feed gravity. Water carryover from V-1102.	Set 11-PC-059 to correct pressure or Run on bypass till valve is fixed. Check V-1102 interface level. Check anti-form injection.	Set 11-PC-059 to correct pressure or Run on bypass till valve is fixed. Check V-1102 interface level. Check anti-form injection.		
11PD055	V-1103 pressure differential		dp is contingent upon having V-1103 level between 45% and 55%.	Less than 11.5 psid	12.5 psid	N/A	Foaming in V-1103 can cause a major 4 Crude Unit upset and possible cavitation and loss of P-1102's.	• Some Light Crudes (ie. AXL and/or AL crude). • Poor Desalter Operation.	For some light crude: Operate the flash drum as low a pressure as possible. Run the desalter temperature as high as practical. Alarm gives operator notification 20 minutes prior to going over the top of V-1103 if alarm condition use 4CL-EP-403.	For some light crude: Operate the flash drum as low a pressure as possible. Run the desalter temperature as high as practical. Alarm gives operator notification 20 minutes prior to going over the top of V-1103 if alarm condition use 4CL-EP-403.	
11LV052	Desalter interface level controller.	Works with 11-LB-052C.	0.02-0.05%	0.1%	0.0%	High = foaming, loss suction on pumps, high pressure in Flash Drum.	Water carry over from V-1102.	Check and adjust V-1102 interface level.	Check and form injection.	Check and form injection.	

No. 4 Crude Unit	PROCESS VARIABLE	CURRENT DESCRIPTION	COMMENTS	NORMAL RANGE	LOWEST LIMIT	CONSEQUENCE OF DEVIATION	PROBABLE CAUSE	CORRECTIVE ACTION	Consequence of Deviation	
									TO HIGH	TO LOW
1IFC182	Hot Crude Recycle	Used to heat up V-1103 Flash Drum to maintain deep flash margin		20-25 MBPD	35	5	High Flow.		• Too much flow through Hot Crude Recycle line. • In sufficient flow through Hot Crude Recycle line.	• Reduce 11FC182 flow rate. • Check V-1103 AP (Foaming) • Start anti-foam injection as needed
							• C-1102's upset • Too low F-1100A/B inlet Pressure			
							Low Flow.			
							• Increased fouling in back end of secondary exchanger train due to no maintaining deep flash margin.			
SECONDARY FEED PUMP: 1IFC059	V-1103 pressure.	11-PI-059		25-30 PSIG	60PSIG	20PSIG	Low = low suction on Secondary feed pumps.	11-PC-059 not set at right pressure or failure of valve.	Set 11-PC-059 to correct pressure.	
							Changes in feed gravity.		Run on bypass till valve is fixed.	
							Water carryover from V-1102.		Check V-1102 interface level.	
									Check anti-foam injection.	
1IFC541	Secondary Exchange/ Train H/Cs	Low heat recovery		280-310°F	320°F	280°F	F-1100A/B overload.	HC's not optimum.	Optimize heat recovery by adjusting HC's for more heat transfer.	
1IFL000	Atmospheric Furnaces inlet pressure.	N/A	415-440PSIG	450PSIG	340PSIG	Over pressure exchangers.	HC's closed off.	Reduce discharge pressure of P-1102's.		
						Damage equipment.	Exchanger foiling.	Open P-1102's discharge valves as needed to increase pressure.		
						Unstable flow.	Discharge valve of pumps closed too much.			
						Crude flashing in tank.				
FURNACES: F-1100A/B and F-1100B	Detailed crude feed to F-1100A/B	N/A	N/A	BurnBD						
1IFL050	F-1100A Transfer Temperature	High temperature	N/A	720°F	N/A		Loss of feed to F-1100A/B	Low level in V-1103.	Check 11TC054 operation.	
							Overheating and coking of pass flows.	Low pressure in V-1103.	Raise V-1103 pressure.	
								Foaming in V-1103.	Check P-1102's operation	
11TH001	F-1100A Transfer Temperature	High temperature	N/A	720°F	N/A		Cooking furnace	Closure of one or both secondary feed H/Cs.	Set 11TC011 on manual and reduce furnace firing.	
							Tube coking.		Turn off burners as needed.	
							Tube failure.		Lower fuel gas pressure.	
11TH011	F-1100B Transfer Temperature	High temperature	N/A	720°F	N/A		Cooking furnace	Malfunlison of 11TC001.	Set 11TC011 on manual and reduce furnace firing.	
							Tube coking.	Malfunlison of 11PC013.	Turn off burners as needed.	
							Tube failure.	Tube rupture.	Lower fuel gas pressure.	
1IFL131 thru 1IFL138	F-1100A pass flows 1 thru 8.	Should be balanced	N/A	4.31MBD			Cooking/heating and coking of pass flows.	Loss of secondary feed pump.	Verify secondary feed pumps are on.	
									Check secondary item H/C's	
									Open individual pass flow controllers	
									Open bypass around pass flow controller or handback.	



No. 4 Crude Unit		B&E Division		Consequence of Deviation		Corrective Action	
Process Variable	Equipment Description	Normal Range	Upper Limit	Lower Limit	Probability of Occurrence	Probability of Detection	Consequence of Deviation
XAD01 XA011 XA081	CO Analyzer F-1100A Stack F-1100B Stack F-1160 Stack	N/A	N/A	High = 500ppm AND Bridgewall temp <1150°F AND secondary ON	N/A	Low feed rate. Low transfer temp. set-point. Start-up or shutdown.	Operating condition. Operating condition due to feed composition. Planned or unplanned event.
T1699	Arch Temperature	N/A	1300-1500°F	1500°F	N/A	Furnace bogging.	Furnace bogging.
as read at DCS/Honeywell	Furnace Draft ("arch" draft as read at inlet to convection system)	11PH008 F-1100A High pressure. 11PH018 F-1100B High pressure.	-0.05 to -0.1"	High draft	N/A	Coking. Weaker tube walls. Possible tube rupture. Waste heat. Over fire furnaces. High O <sub>2</sub> .	Too cold from Desalter. Feed rate too high..
11PC111 11PC211 11PC622	Fuel gas pressure. F-1100A F-1100B F-1160	N/A	25 - 55PSIG	58PSIG (Hi-H) 53PSIG (Right)	N/A	0 or positive Unstable flame Combustibles exiting furnace slack. Combustibles in furnace. Not enough draft.	Slack damper open too much. Close down on slack damper.
F-1100 A&B F-1160	Furnace Burner—burn back or flash back	N/A	N/A	N/A	5PSIG (Low) 3PSIG (LoLo)	Flame out. Unstable flame	Open slack dampers.
						Flame burning back into the throat of the burner. Damage to the burner. Potential external flame out of back of burner assembly and exposure to personnel.	Adjust feed rate. Clean burners. Vaporize fuel gas in E-370 to control BTU value.
						Insufficient air to the burner or plugged licensure fuel gas tip.	Adjust system fuel gas pressure at a pressure vessel. Full burners as required. Verify plant fuel gas pressure.
						• Flame burning back into the throat of the burner. Damage to the burner. Potential external flame out of back of burner assembly and exposure to personnel.	• Open air registers fully. This additional air should push the flame out of the L-enture. If this does not stop the burn-back, block in the fuel gas to the whole burner (both the gas to the primary venturi and the secondary leg). Allows the burner to cool and then re-light. • If burner cool-down and re-light does not correct burner and clean out the flenture fuel gas tip.

No. & Crude Unit	PROCESS EQUIPMENT VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS	D&R DIVISION	NORMAL RANGE	UPPER POWER LIMIT	CONSEQUENCE OF DEVIATION	PROBABLE CAUSE	CORRECTIVE ACTION	Consequence of Deviation	
					LOW	HIGH	LOW	HIGH		LOW	HIGH
F-1100 A&B 11PC111 11PC211	Harmonic oscillation in F-1100 A&B	N/A	25-35 PSIG 5 PSIG (Low) 58 PSIG (High)	5 PSIG (Low) 3 PSIG (Low/High)	5 PSIG (High) 58 PSIG (High/High)	5 PSIG (Low)	Frequency of burners is in sync with the harmonics of the furnace.	• Harmonic oscillation causing the furnace draft to fluctuate rapidly from negative to positive. • Personnel can sit exposed to hot combustion gases, when the furnace goes positive. • Draft fluctuations can damage the furnace because hot gases are leaving the box, as well as the pressure fluctuations can damage the furnace shell.	• Keep the burner pressure above 35 PSIG to prevent harmonic frequency. Block in one venture on selected burners to keep fuel gas pressure above 35 psig, or until oscillation stops. • If harmonic frequency occurs, raise furnace pressure up to 45+ psig, by blocking in whole burners. • Open stack damper then open up inlet air plenum. • These moves should reduce harmonic frequency in 20-40 minutes. • If harmonic frequency becomes too severe to maintain operations, move to the plant shutdown posture, up to and including shutting down the plant.	Initiates worker for filter change when ΔP reaches 15 psig.	
K-1196 Fuel Gas Coefficient FD9883	Differential Pressure	N/A	Up to 15 psig	17 psig	N/A	N/A	Damage to filter elements. Liquid and particulate carry-over to burners (possible burner plugging).	Dirty fuel gas.	Bypass condenser when maintenance is ready to replace filter elements.	By-pass filter, if ΔP > or = to 17 psig.	
G9861 G9862	Filter level Gauge-upper Filter level Gauge-lower	N/A	Empty	Liquid present	N/A	N/A	Liquid and particulate carry-over to burners (possible burner plugging).	Liquid carry-over from KO drum.	Blowdown (upper and lower). Check 5Hz and V-1196 for source of liquid carry-over.		
T1016 to - 024 T-116 to - 124 T-1612 to - 625	Furnace outlet temperature F-110DA F-110B F-1160	N/A	F-1100A/B 710°F.	720°F	N/A	N/A	Coking in furnace tubes. Possible hot spots or tube rupture.	Change in feed rate or feed composition. Change in the BTU value of the fuel gas.	Adjust transfer line temperatures.	Cut fuel gas pressure as necessary. Change feed rate as required.	
A000N A000S A010N A010S	O2 Analyzer: F-1100 A-North F-1100A-South F-1100B-North F-1100B-South	Alarms: X100N (11AT00B) X100S (11AT00E) X101N (11AT10B) X101S (11AT10E) XA000 XA010	2-3%	5%	N/A	0.8%	Uneconomical operation.	Furnace out of adjustment.	Adjust furnace.	Adjust damper registers open.	
A000N A000S	O2 Analyzer: F-1100-North F-1100-South	Alarms: X100N (11AT60B) X100S (11AT60E) XA000	2-3%	5%	N/A	0.8%	Uneconomical operation.	Furnace registers closed off. Furnace damper closed off. Furnace firing too hard.	Adjust damper registers open.	Adjust damper open.	

No. 4 Crude Unit	PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS	D&R Division		PROBABLE CAUSE	CONSEQUENCE OF DevIATIon	LIMIT	CORRECTIVE ACTION
				NORMAL RANGE	UPPER LIMIT				
A1004 A1014 A1064	CEMS Analyzer F-1100A F-1100B F-1160	Continuous Emissions Monitoring System measures NOx and O2 at the Furnace Stack. Informational data for BAQMD.	15-20 ppm	>20 ppm	<12 ppm	Analyzer failure.	Values outside normal range may indicate analyzer failure - may lead to refinery air quality violation.		Inform maintenance and issue work order immediately. Inform RSC and Environmental Coordinator.
FI-131 lo- 138 FI-231 lo 238 FI-601 lo 608	Pass flow rate, F-1100A F-1100B F-1160	F-1100A/B F-1160	9.16 Thousand 9.13 Thousand	20 Thousand 17 Thousand	8.4 Thousand 8.4 Thousand	Tube overheating, Coking. Tube rupture. Imbalance heat distribution,	Low secondary feed. Pass flows not balanced correctly. Pass flow meter calibration problem.		Balance the flows manually. Check passes flow control instrumentation.
T1028 T1128 T1605	Superheated Steam Outlet Temperature F-1100A F-1100B F-1160	N/A	N/A	700°F, 800°F, max.	N/A	Tuna overheating.	Low steam rate.		Increase steam rate of vent outlet to atmosphere.
T1061 to T1063 T1072 to T1079 T1091 to T1093	Skin temperatures, F-1100A F-1100B	N/A	700-800°F	1100°F	N/A	Coking. Tube overheat, hot spots, possible tube rupture.	Flame Impingement.		Adjust burner flame pattern. Adjust pass flows.
T1161 to T1168 T1172 to T1179 T1181 to T1188									
T1623 to T1629 T1631 to T1634 T1635 to T1639 T1641 to T1643 T1686 to T1689 T1691 to T1 694	F-1160								

No. 4 Crude Unit						D&R Division		
PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS	NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DEVIATION	PROBABLE CAUSE	CORRECTIVE ACTION
1FCD05	C-1100 Overhead pressure.	N/A	22-28 PSIG.	30 PSIG.	N/A	Lift safety valves.	Pressure exceeds normal range.	Reduce pressure.
						Side cuts go off spec.	K-1100 overloaded.	Back out TKC Naphtha/let it being fed.
						N/A 18 PSIG	K-1100 spill back failed closed.	Cut back K-1100 load.
						Side cuts go off spec.	K-1100 not loaded.	Sample crude and make adjustments.
							E-1100's in fans not all in service.	Speed up K-1100.
							Crude slate has high light-ends content.	Start additional E-1100 in fans.
							Overheated exchangers are fouled, too few running.	
TI-029	Flash Zone Temperature	Controlled by furnace firing rate ABCR, & pump back.	600-710°F	715°F	N/A	Tiny coking.	Firing furnace too hard.	Decrease furnace transfer line temperature.
						Increased Δ pressure.	Lack of ABCR and/or pump back.	Increase ABCR or pump back.
						N/A 600°F	High ABCR or pump back.	Increase transfer line temperature.
1FCD05	Overhead reflux rate.	N/A	25-35MBPD	45MBPD	N/A	Flooding.	Circulating reflux rates set to high.	Cut ABCR or pump back.
						High Δ pressure.	C-1100 top temperature set to High.	
						Carryover of heavy ends.		Check v-1100 level controller.
						Poor fractionation.		Bypass control valve as required.
						N/A 20MBPD	Dry trays.	
						Poor fractionation	Loss of P-1100's.	
						High overhead temperature.	No level in V-1100.	Start one of the P-1100's.
PD-006	C-1100 API pressure.	Tower flooding.	6-8.5 PSIG	8.1 PSIG	N/A	Poor product separation in column.	Bypass control valve as required.	Check y-1100 level controller.
							Reflux or pump around rates too high.	
							Need to draw more product.	
							No. 5 SCFB rate is too high.	
							Slipping steam rate is too high.	
							Wash oil trays are plugging off.	
1FCD05	ATCR rate	N/A	120-175MBPD	108MBPD	N/A	Column Δ P too high.	Check calculation for Δ between ABCR suction pressure and flash zone pressure.	
						C-1100 overhead temperature out of range.	Set ATCR at efficient rate to ensure top reflux is operating in acceptable range.	
						N/A 40MBPD		
1FCD04B	ABCR rate	N/A	35-40MBPD	55MBPD	N/A	Column tray flooding.	Shut ATCR if sufficient rate to ensure top reflux is operating in acceptable range.	
						Column Δ P too high.	Shut ABCR at sufficient rate to ensure top reflux is operating in acceptable range.	
						C-1100 overhead temperature out of range.	Set ABCR at efficient rate to ensure top reflux rate is operating in acceptable range.	
						N/A 25MBPD	Dry trays.	
							Rate too low.	
							Rate too high.	
								Set ABCR at efficient rate to ensure top reflux rate is operating in acceptable range.

No. 4 Crude Unit		D&R Division		Consequence of Deviation				Corrective Action	
PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS	NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DEVIAITION	PROBABLE CAUSE		
11LC000	Bullions level too high.	11LH006 High level 11LL005 Low level	40-60%	60%	10%	High level	<ul style="list-style-type: none"> <li>Column flooding.</li> <li>Poor product separation.</li> <li>High column delta pressure.</li> <li>Loss of flow to F-1160</li> <li>Loss of flow through F-1180 pass flows and tube coking.</li> </ul>	<ul style="list-style-type: none"> <li>Plant has become feed rate limited.</li> <li>Not enough P-1105's on line.</li> <li>Flash zone temperature too low.</li> <li>F-1160 pass flow controllers are too far closed.</li> <li>Malfunction of 11LC000.</li> </ul>	<ul style="list-style-type: none"> <li>Report plant limited. Direct crude slate change from planning.</li> <li>Start up an additional P-1105.</li> <li>Raise furnace outlet temperatures.</li> <li>Check valve positions.</li> <li>Open valve bypass if necessary.</li> <li>Check 11LC000 operation.</li> <li>Activate F-1160 emergency circulation Reduce sidecut draws.</li> </ul>
11LC001	Rafflux Drum Level.	11LH011 High Level 11LL011 Low level	40-50%	BD5%	10%	High level	<ul style="list-style-type: none"> <li>Loss of feed to C-1190</li> <li>Loss of C-1100 OH reflux</li> <li>Off spec product.</li> </ul>	<ul style="list-style-type: none"> <li>Level indication is bad.</li> <li>Bottom level controller or pump has failed.</li> <li>Level control valve 11LC000 has failed.</li> <li>P-1100's unable to put up enough flow rate or S/D.</li> <li>High level in V-1104.</li> </ul>	<ul style="list-style-type: none"> <li>Compare level indication to gauge glass. Direct I&amp;E to calibrate level indication.</li> <li>Check discharge pressure. Switch to an alternate pump. Start an additional pump.</li> <li>Check 11LC000 operation.</li> <li>Stop feed to C-1190 to re-establish C-1100 OH reflux.</li> <li>Set C-1100 on total reflux if C-1100 OH reflux is not re-established quickly.</li> </ul>
11LC022	V-1100 Boot level controller	11LH022 High Level 11LL022 Low Level	50%	80 h.	24 h.	High level	<ul style="list-style-type: none"> <li>Water in C-1100 OH.</li> <li>Possible C-1100 high pressure.</li> <li>Water in C-1180 feed.</li> <li>Naphtha underrate to V-1160 resulting in C-1160 high pressure.</li> </ul>	<ul style="list-style-type: none"> <li>Malfunction of 11LC002.</li> <li>Failure of P-1103.</li> <li>Malfunction of 11LC002.</li> </ul>	<ul style="list-style-type: none"> <li>Manually lower boot level or open bypass around 11LC002.</li> <li>Start both P-1103's.</li> <li>Shutdown P-1103 until level is restored.</li> <li>Check 11LC002 operation.</li> </ul>
11LC003	V-1104 interface level controller	11LL003 Low level	50%	N/A	24 h.	Naphtha underrate to V-1160 resulting in C-1160 high pressure.	Malfunction of 11LC003	<ul style="list-style-type: none"> <li>Check 11LC003 operation.</li> <li>Block in controller until level is re-established.</li> </ul>	<ul style="list-style-type: none"> <li>Reduce stripping steam rates.</li> </ul>
11FC002	Stripping steam too high or too low.	N/A	10-12MP/H.	16MP/H.	6MP/H.	Dry tray in stripping section.	Stripping steam rate is too high.	<ul style="list-style-type: none"> <li>Sample products upstream and downstream of suspect exchanger.</li> <li>Sample product in end cut of suspect Reboiler.</li> <li>Check valve line up at rousing manifolds. Fast closed valve bodies for leakage.</li> </ul>	<ul style="list-style-type: none"> <li>Crude/Product exchanger is leaking.</li> <li>Stripper Reboiler leaking.</li> <li>Cross contamination at pilot limit routing.</li> </ul>
N/A	All product streams.	Any product is dark or has high end point.	N/A	N/A	N/A	Off spec products.			

No. 4 Crude Unit		D&R Division		Consequence of Deviation					
PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS		NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DEVIATION	PROBABLE CAUSE	CORRECTIVE ACTION
11FC041 11FC051	4 side cut 5 side cut	4 <sup>th</sup> or 5 <sup>th</sup> side-cut are dark.	N/A	N/A	N/A	N/A	Off test products.	No. 5 SCPB rate is too low. Flash zone temperature is too high. Tray damage in wash oil section.	Increase No. 5 SCPB rate. Reduce flash zone temperature. Check & Pressure between ABPA suction and flash zone.
Y-108 CBR RÖSCH 11Q1-V100 OH-P-CHLOR	V-1100 Chlorides	N/A	N/A	50 ppm	N/A	N/A	If chloride level is above 50 ppm, excessive corrosion due to chloride ions can occur. Caustic injection rates can be increased to reduce this level. Allowing a minimum of at least 5 ppm chloride while injecting caustic will reduce downstream effects (furnace fouling, stress corrosion cracking, fouling on downstream catalysts).	Injection plugged, injection rate too low.	Decrease caustic injection.
F-1160 VACUUM FURNACE FL000	F-1160 Feed Low flow	N/A	N/A	N/A	32MBD	N/A	Loss of flow through F-1160 and possible coking of furnace tubes.	Loss of crude feed • Low level in C-110 caused by malfunction of LC000. • Failure of P-1105/A • Too much velocity steam	Set LC000 to manual and re-establish flow. If levels is too low, drop No. 5 AC and recycle C-110 bottom to F-1160 until level in C-110 is re-established. Start spare P-1105 if it did not come up on AFS. Activate F-1160 short loop circulation. Decrease velocity steam.
11F-001 11FL608	F-1160 pass flows 1 thru 8. Passes should be balanced.	N/A	N/A	4MBD	N/A	N/A	Loss of flow through F-1160 and possible coking of furnace tubes.	Low level in C-110 caused by malfunction of LC000. Failure of P-1105/A Too much velocity steam	Set LC000 to manual and re-establish flow. If levels is too low, drop No. 5 AC and recycle C-110 bottom to F-1160 until level in C-110 is re-established. Start spare P-1105 if it did not come up on AFS. Activate F-1160 short loop circulation. Decrease velocity steam.
11TR050	F-1160 Transfer Temperature	High temperature	N/A	830°F	N/A	N/A	Oversizing furnace • Tube coking. • Tube failure.	Malfunction of 11TC060, Malfunction of 11PC603. Tube rupture.	Set 11TC060 on manual and reduce furnace firing. Turn off burners as needed. Lower fuel gas pressure.
11TR605	F-1160 #50 steam superheater coil outlet temperature	N/A	N/A	800°F	N/A	N/A	Tube failure	Loss of flow through superheater coil. Oversizing furnace	Set 11TC060 on manual and reduce furnace firing. Turn off burners as needed. Lower fuel gas pressure.

No. 4 Crude Unit	PROCESS VARIABLE	EQUIPMENT DESCRIPTION	DAR Division	NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DEVIATION	PROBABLE CAUSE	CORRECTIVE ACTION		Consequence of Deviation
									COMMENT	REASON	ACTION
11LH006	C-1160 Bottoms High level	11LH661 High Level 11LL662 Low Level	N/A	64 in.	53 in.	High Level	<ul style="list-style-type: none"> <li>Flooding of C-1160 stripping section.</li> <li>Potential packing bed damage if level rises above stripping steam inlet.</li> </ul>	<ul style="list-style-type: none"> <li>11LC061 malfunction.</li> <li>Loss of P-1165's.</li> </ul>	High Level	<ul style="list-style-type: none"> <li>Check 11LC061 operation.</li> <li>Start spare P-1165's.</li> <li>Open 11LC061 operation.</li> <li>Reduce feed to C-1160.</li> </ul>	
11PC831	Overhead vacuum.	Inufficient vacuum.	N/A	26-29 inches of Hg.	12 inches of Hg.	Low Level	<ul style="list-style-type: none"> <li>Loss of P-1165/A suction.</li> </ul>	<ul style="list-style-type: none"> <li>Malfunction of 11LC061.</li> </ul>	Low Level	<ul style="list-style-type: none"> <li>Check 11LC061 bypass is closed.</li> <li>Close 11LC061.</li> </ul>	
11PL632	C-1160 OH to relief	N/A	N/A	14.7 psia	N/A	N/A	<ul style="list-style-type: none"> <li>Loss of vacuum.</li> <li>Inefficient column operation.</li> <li>Products off spec.</li> <li>High level in C-1160.</li> </ul>	<ul style="list-style-type: none"> <li>Vacuum leak.</li> <li>Flash zone temperature too high, causing cracking.</li> <li>Barometric leg is plugged.</li> <li>V-1160 high level.</li> <li>15PSIG steam is low.</li> <li>Overhead condensers are fouled or leaking cooling water.</li> <li>Malfunction of 11PC831.</li> <li>Vacuum jets pinched.</li> <li>Vacuum jets plugged.</li> </ul>	<ul style="list-style-type: none"> <li>Ensure 11PC831 is blocked in.</li> <li>Decrease F-1160 outlet temperature.</li> <li>Feel barometric legs temperature for free flow.</li> <li>Compare level in gauge glass to indication.</li> <li>Switch reductors. Direct utilities operators to increase steam pressure.</li> <li>Check condensers for heat gradient.</li> <li>Compare cooling water in and out temperatures.</li> <li>Ensure good cooling water flow to vac. condensers.</li> <li>Ensure barometric legs are sealed.</li> </ul>		
11FL078	C-1160 Overflash low flow	N/A	N/A	N/A	2.5WBD	N/A	<ul style="list-style-type: none"> <li>Relief header gas will be drawn into C-1160 causing pressure problems.</li> <li>Potential for air to be drawn into vacuum system.</li> </ul>	<ul style="list-style-type: none"> <li>Failure of P-1178/A</li> </ul>	11PSV824 on C-1160 OH is leaking.	<ul style="list-style-type: none"> <li>Reset PSV</li> <li>Shutdown unit.</li> </ul>	
TI-649	Flash zone temperature	N/A	N/A	755-770°F	775°F	N/A	<ul style="list-style-type: none"> <li>Loss of overhead packing tied.</li> <li>Loss of vacuum.</li> </ul>	<ul style="list-style-type: none"> <li>Failure of P-1178/A</li> <li>11FC078 failure / closed</li> </ul>	<ul style="list-style-type: none"> <li>Start spare P-1178.</li> <li>Check 11FC078 operation.</li> </ul>		
TI-652	C-1160 Overhead Temperature.	N/A	N/A	40°F	150°F	N/A	<ul style="list-style-type: none"> <li>Temperature over 40°F exceeded SIS limit. Temperatures below 150°F will cause water in column to condense which may cause internal damage to C-1160.</li> <li>Exceeding SIS limits could lead to E-1160 and E-1161 total bundle failures.</li> </ul>	<ul style="list-style-type: none"> <li>Flash zone temperature too high causing cracking.</li> <li>VTCR rate too high or too low</li> </ul>	<ul style="list-style-type: none"> <li>Decrease F-1160 outlet temperature.</li> </ul>	Adjust VTCR rate to return C-1160 overhead temperature to optimum	
11FC059	VTCR rate is too low.	N/A	20-36MBPD	50MBPD	18.8MBPD	D	<ul style="list-style-type: none"> <li>Vacuum column overhead temperature could drop below 150°F causing water to condense and causing internal damage to C-1160.</li> </ul>	N/A	Adjust VTCR rate to return C-1160 temperature to optimum.		

No. 4 Crude Unit	PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DEVIATION	PROBLEMS/CAUSE	CORRECTIVE ACTION		Consequence of Deviation
								REASON	ACTION	
11FC068	VTCR rate is too high low	N/A	20-35MBPD	50MBPD	18.8MBPD D	Vacuum column overhead temperature could exceed 400°F which would exceed SIS limits.	N/A	Adjust VTCR rate to return C-1160 overhead temperature to optimum.	N/A	
FC-48B	VBCR rate too high or too low	N/A	35-45MBPD	70MBPD	25MBPD	Pinchle tears or worse in the E-160 and E-161 bundles if temperature exceeds 400°F.	N/A	N/A	N/A	
FC-48B	No. 8 Side-cut is dark.	N/A	18-25MBPD	25MBPD	17MBPD	Product off test.	Flash zone temperature is high, causing Coking.	Decrease F-1160 outlet temperature.	Increase No. 8 SIC pump back rate, Start additional P-1178.	
11L1061	Bottoms level	High	40-60%	50%	10%	Product off test.	Insufficient No. 8 SCOPB rate. P-1178 can't pump level off stripping tray, Exchanger in No. 8 SIC or VBCR service is leaking. Wash oil section packing or tray damage.	Sample product upstream and downstream of suspected exchanger.	Check discharge pressure on P-1165's. Switch pumps or add another pump. Report limit. Direct crude slate change from planning. Bypass and clean strainer. Increase bottoms quench.	
11LC054	V-1160 Seal Drum oil level	11LH084 High level.	40-60%	100%+	10%	Loss of vacuum. Oil carryover to vent gas compressors.	P-1160's gassed up or foaming suction. Level indication bad.	• Switch pumps and/or vent pumps, compare indication to gauge glass. Open bypass around 11LC084.	•	
11LC063	V-1160 Seal Drum water level	N/A	40-60%	70%	10%	Low to V-1109 causing emulsion, poor operation of Desalter. High = Water sent to P-1101 suction. More BFVW has to be used in V-1109.	Meter failure.	Repair meter.	•	
7.S/C Seal Fluid System	7 SIC seal flush low pressure	N/A	N/A	250 PSI	150 PSI	Loss of seal flush to hot oil pumps. Seal damage / failure.	11PC073 malfunction. Loss of 7 SIC.	• Check 11LC073 operation, restore 7 SIC.	• High DP at K-1109's. High DP at K-1179's.	
C-1160 Stabilizer	C-1160 bottoms level	Low level	N/A	N/A	41 in.	Loss of feed to NHT. P-1195 cavitation	Malfunction of 11LC090.	•	Switch and Change out K-1109 / K-1179 filters.	
11LC060	C-1160 bottoms level	Low level	N/A	N/A	41 in.	P-1195 cavitation	Malfunction of 11LC090.	•	Close 11LC090.	

No. 4 Crude Unit	PROCESS VARIABLE	EQUIPMENT DESCRIPTION	DER Division	NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	SEQUENCE OF OPERATION	PROBABLE CAUSE	CONSEQUENCE OF UPSET		CORRECTIVE ACTION	SEQUENCE OF DIVISION
									High Level	Low Level		
11LC082	V-1180 boot level controller	11LL092 High level 11LL092 Low level	40-60%	34 in.	15 in.	N/A		• Water in C-1180 reflux stream • Undercut of C4 to V-1160. • C-1180 upset.	High Level	• Malfunction of 11LC092. • Malfunction of 11LC092.	• Bypass 11LC092 to lower level. • Pinch down on 11LC092 block valves.	High Level
Compressor												
11LH712A/B	V-1170A K-1100A&B 1 <sup>st</sup> stage KO drum.	N/A	N/A	22 in.	N/A		K-1100A/B shuts down. 11PC09A opens to route off gas to flare.	• Liquid carryover to compressor. • Possible compressor S/D.		High level in V-1170A	• Manually lower V-1170A.	
11LH711	V-1170A K-1100A&B 1 <sup>st</sup> stage KO drum.	N/A	N/A	16 in.	N/A							
11LH761	V-1169A K-1100A interstage KO drum.	High level High level S/D	N/A	18 in.	N/A	22 in.		• K-1100A shuts down. • Liquid carryover to compressor. • Possible compressor damage.	High level in V-1169A	• Manually drain liquid to relief. • Check 11LC765 operation.		
11LH762	K-1100A 1 <sup>st</sup> stage dP	N/A	N/A	33 psig.	N/A							
11PH761	K-1100A 2 <sup>nd</sup> stage dP	N/A	N/A	80 psig.	N/A			• Damage to compressor and driver.	Compressor overloaded.	Check compressor loading.		
11PH763	K-1100A 2 <sup>nd</sup> stage dP	N/A	N/A	N/A	N/A			• Damage to compressor and driver.	Compressor overloaded.	Check compressor loading.		
11LC028	K-1100A cylinder lube oil low level shutdown	N/A	N/A	N/A	N/A		Excessive cylinder and piston wear.	Low level in cylinder/lube oil reservoir.	Refill reservoir.			
11VH026	K-1100A vibration	N/A	N/A	N/A	N/A		K-1100A shuts down. 11PC09A opens and routes off gas to relief.	Excessive vibration.	• Check suction and discharge dampers for liquid. • Start spare compressor.	• Have maintenance bar over compressor and check rotation.		
11PL025A	K-1100A Frame Lube oil low pressure & S/D	N/A	N/A	N/A	8 psig 5 psig (S/D)		Insufficient lubrication. K-1100A shuts down. 11PC09A opens and routes off gas to relief.	• Oil filter plugged. • Oil reservoir low level. • Excessive bearing clearance or oil pump failure.	Switch and replace filter. Check reservoir level.	• Replace filter.		
11PL025B	K-1100A filler dP high	N/A	N/A	18 psig.	N/A		Lube oil pressure decreases.	• Line oil filter plugged. • K-1100A shuts down. • Liquid carryover to compressor.	High level in V-1169B	• Manually drain liquid to relief. • Check 11LC766 operation.		
11PH024	V-1169B K-1100B interstage KO drum.	High level High level S/D	N/A	16 in.	N/A	22 in.		• Possible compressor damage.	Compressor overloaded.	Check compressor loading.		
11LH763	K-1100B 1 <sup>st</sup> stage dP	N/A	N/A	33 psig.	N/A			• Damage to compressor and driver.	Compressor overloaded.	Check compressor loading.		
11LH764	K-1100B 2 <sup>nd</sup> stage dP	N/A	N/A	80 psig.	N/A			• Damage to compressor and driver.	Compressor overloaded.	Check compressor loading.		
11LC021	K-1100B cylinder lube oil low level	N/A	N/A	N/A	N/A		Excessive cylinder and piston wear.	Low level in cylinder/lube oil reservoir.	Refill reservoir.			

No. 4 Crude Unit	PROCESS EQUIPMENT VARIABLE DESCRIPTION	DAR Division	NORMAL RANGE	UPPER CONSEQUENCE OF DEVIATION LIMIT	LOWER CONSEQUENCE OF DEVIATION LIMIT	PROBABLE CAUSE	CORRECTIVE ACTION		CONSEQUENCE OF Deviation
							Comments	Action	
11VH026	K-1100B vibration shutdown		N/A	N/A	N/A	K-1100B shuts down, off gas to relief.	Excessive vibration.	<ul style="list-style-type: none"> <li>Check suction and discharge dampers for liquid.</li> <li>Start spare compressor.</li> <li>Have maintenance bar over compressor and check rotation.</li> </ul>	
11P027A 11P027B	K-1100B Frame lube oil low pressure & S/D		N/A	N/A	N/A	K-1100B shuts down, 11PC008A opens and routes off gas to relief.	<ul style="list-style-type: none"> <li>In sufficient lubrication.</li> <li>K-1100B shuts down.</li> <li>11PC008A opens and routes off gas to relief.</li> </ul>	<ul style="list-style-type: none"> <li>Oil filter plugged.</li> <li>Oil reservoir low level.</li> <li>Excessive bearing clearance or oil pump failure.</li> </ul>	
11PH026	K-1100B Filter dp high		N/A	N/A	18 psig.	N/A	Lube oil pressure decreases.	<ul style="list-style-type: none"> <li>Lube oil filter plugged.</li> <li>Malfunction of 11LC742.</li> </ul>	
11LH741	V-1171 K-1171A 1 <sup>st</sup> stage KO drum.		N/A	N/A	16 in.	N/A	<ul style="list-style-type: none"> <li>Liquid carryover to compressor.</li> <li>Possible compressor S/D.</li> <li>Possible compressor damage.</li> </ul>	<ul style="list-style-type: none"> <li>Failure of P-1171A.</li> <li>High level in V-1171.</li> </ul>	<ul style="list-style-type: none"> <li>Replace filter.</li> <li>Check 11LC742 operation.</li> <li>Start both P-1171's.</li> <li>Use P-1198 to take suction of V-1171.</li> </ul>
11LH743A& B	V-1171 High level		N/A	N/A	22 in.	N/A	K-1171A shuts down.	High level in V-1171.	<ul style="list-style-type: none"> <li>Pump out V-1171.</li> <li>Restart compressor.</li> </ul>
11LH755 11LH751	V-1172 High Level V-1172 High Level S/D		N/A	22 in. (S/D)	N/A	K-1171 shuts down.	<ul style="list-style-type: none"> <li>High level in V-1172.</li> <li>Interstage KO pot.</li> </ul>	<ul style="list-style-type: none"> <li>Re-establish loop seal.</li> <li>Blowdown liquid from V-1172.</li> <li>Restart compressor.</li> <li>Re-establish loop seal.</li> <li>Check E1172 for cooling H2O leak.</li> </ul>	
11LQ038	K-1171 cylinder lube oil low level		N/A	N/A	N/A	K-1171	<ul style="list-style-type: none"> <li>Excessive cylinder and piston ring wear.</li> </ul>	<ul style="list-style-type: none"> <li>Low level in cylinder tube oil reservoir.</li> <li>Refill reservoir.</li> </ul>	
11VH035	K-1171 Vibration shutdown		N/A	N/A	N/A	K-1171 shuts down.	<ul style="list-style-type: none"> <li>Loop seal blown VG to relief.</li> </ul>	<ul style="list-style-type: none"> <li>Check suction and discharge dampers for liquid.</li> <li>Start spare compressor.</li> <li>Have maintenance bar over compressor and check rotation.</li> </ul>	
11P035A 11P035B	K-1171 Frame lube oil low pressure & S/D		N/A	N/A	N/A	K-1171 shuts down.	<ul style="list-style-type: none"> <li>In sufficient lubrication.</li> <li>K-1171 shuts down.</li> <li>Loop seal blown VG to relief.</li> </ul>	<ul style="list-style-type: none"> <li>Oil filter plugged.</li> <li>Oil reservoir low level.</li> <li>Excessive bearing clearance or oil pump failure.</li> </ul>	
11PH034	K-1171 Filter dp high		N/A	18 psig.	N/A	Lube oil pressure decreases.	Lube oil filter plugged.	Replace filter.	
11LH782 11LH783	V-1172A High Level S/D V-1172A High Level		N/A	22 in. (S/D)	N/A	K-1171A shuts down.	<ul style="list-style-type: none"> <li>High level in V-1172A.</li> <li>Interstage KO pot.</li> </ul>	<ul style="list-style-type: none"> <li>Blowdown liquid from V-1172A.</li> <li>Restart compressor.</li> <li>Re-establish loop seal.</li> <li>Check E1172A for cooling H2O leak.</li> </ul>	
11LQ031	K-1171A cylinder lube oil low level		N/A	N/A	N/A	Excessive cylinder and piston ring wear.	Low level in cylinder tube oil reservoir.	Refill reservoir.	
11VH036	K-1171A Vibration shutdown		N/A	N/A	N/A	K-1171A shuts down.	Excessive vibration.	<ul style="list-style-type: none"> <li>Check suction and discharge dampers for liquid.</li> <li>Start spare compressor.</li> <li>Have maintenance bar over compressor and check rotation.</li> </ul>	

No.	D&R Unit	PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS	NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DEVIATION		PROBABLE CAUSE	CORRECTIVE ACTION	Consequence of Deviation
								High	Low			
1PL037A	K-1171A Frame Lubrication	Oil pressure & S/D	N/A	N/A	8 psig 5 psig (S/D)	• Insufficient lubrication. • K-1171A shuts down.	• Loop seal blow down to relief.	• Oil filter plugged.	• Oil reservoir low level.	• Excessive bearing clearance or oil pump failure.	• Switch and replace filter. • Check reservoir level.	•
1PL037B	11PLC037B											
1PL038	K-1171A Filter dP High setpt.	Vent gas compression loop	N/A	N/A	10 psig.	N/A	103 in.	• Release of vent gas to flare.	• Lubric oil pressure decreases.	• Lubric oil filter plugged.	• Replace filter.	•
1LL771	11LLC077											
1PL072	K-1171/A 1" stage suction low pressure		N/A	N/A	12 psia			• Inefficient compressor operation.	• High pressure on upstream system causing loop seal to blow.	• Malfunction of 11LC072.	• Bypass 11LC072.	•
V-1175 Degasser	V-1175	High level	N/A	N/A	99 in.	N/A	N/A	Loss of degassing action and liquid carryover to V-1171.	• Malfunction of 11LC073.	• Failure of P-1175/A.	• Bypass 11LC073.	•
<u>Miscellaneous Equipment</u>												
1FH095	4 Crude safety showers	Located at V-1198 & T-1108.	N/A	N/A	N/A	N/A	N/A	Shower flowing due to activation and water flow across sensing element.	• Shower activated	• Check both 4 Crude safety showers.	• Start spare P-1175.	• Open V-1175 skim line.
1FH096	V-1108 Desalter Water Tank	11LC058 11PC075	0-150 in.	N/A	100 in.	N/A	N/A	• Water carryover to V-1171 (K-1171/A) stage KO drum. • Possible compressor S/D.	• Malfunction of 11LC058.	• Malfunction of 11LC058.	• Call Plant Protection if someone has been exposed.	• Adjust 11LC058.
11LH065	V-1164 #50 Steam KO drum.		N/A	N/A	22 in.	N/A	N/A	• Valve to F-1160 separator coats.	• Saturated stripping steam to C-1160.	• Malfunction of 11LC058	• Close block valves on soft water and stripped water makeup.	• Check 11LH065 operation.
11LH771	V-1177 #150 Steam drum	High / Low level	N/A	39 in.	21 in.	High Level	Low Level	• Water carryover to #150 steam system.	• Malfunction of 11LC077.	• Malfunction of 11LC077.	• Pinch block valve at 11LC077 until levels normal.	High Level
11LH088	V-1186 Fuel Gas KO pot.	High level	N/A	16 in.	N/A	Low Level	Low Level	• Water in F-1180's separator coils.	• Malfunction of 11LC077.	• Operate intermittent blowdown to lower level.	• Open 11LC077 bypass.	Low Level
								• Loss of BFW circulation to furnaces.	• Tube damage.	• Entained liquid in fuel gas.	Blowdown V-1186 to relief.	
								• Possible burner plugging.				

No. & Crate Unit	D&R Division	PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS	NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DEVIATION	PROBABLE CAUSE	CORRECTIVE ACTION		Consequence of Deviation
										REASON	REASON	
11PL681A	P-165 Lube Oil Low pressure and Shutdown	11PL681A Low pressure	N/A	N/A	20 psig	15 psig (SD)	18 psig	Insufficient lubrication, P-165 S/D.	Plugged filter cartridge.	Replace filter cartridge.		
11PL681B	P-165A lube oil Low pressure and Shutdown	11PL681B S/D	N/A	N/A	18 psig	18 psig	N/A	Insufficient lubrication, P-165A S/D.	Plugged filter cartridge.	Replace filter cartridge.		
11PL086	40 psig Instrument Air	Low pressure	N/A	N/A	35 psig	N/A	65 psig	Loss of instrument air, Control valve will assume instrument air failure positions.	Auxiliary tube oil pump off.	Start Auxiliary tube oil pump.	Open bypass around instrument air regulation.	
11PL088	100 psig Instrument Air	Low pressure	N/A	N/A	65 psig	N/A	60 psig	EBV's close on less than 60 psig.	Manufacture of 11PCV801 or 11PCV802, Air supply failure from utilities plant.	Stabilize plant according to emergency procedure for loss of 40 psig instrument air.	Stabilize plant according to emergency procedure for loss of 40 psig instrument air.	
XAB51	Miss Oil Generator Common Trouble	Oil reservoir low pressure	N/A	N/A	N/A	N/A	N/A	EBV pumps will shutdown.	Low level	Refill reservoir.	Check air strainer.	
		Low air pressure	N/A	N/A	N/A	N/A	N/A	Loss of misturbation.	Air filter plugged.	Call out maintenance.	Call out maintenance.	
		Low temperature	N/A	N/A	N/A	N/A	N/A	Loss of misturbation.	Air supply pressure low.	Call out maintenance.	Call out maintenance.	
XAB59	Plant 11 Substation Trouble	This alarm sounds to indicate trouble in the power distribution system. Check the annunciator panel in the motor control center and scan the switch gear indicating lights to locate the problem. If the shutdown was caused by a protective relay, that relay will have dropped a small amber colored flag to identify itself.	The annunciation panel has the following windows:						Heater failure			
									Feeder breaker open (two on the 2.4 kv system and four on the 480v system).			
									Emergency power transfer switch (one on the 2.4kv system and one on the 480v system).			
									Transformer or high temperature (one on each transformer- nine in all).			
									Loss of transformer or control power (one for each feeder breaker, one for the 480v emergency transfer switch and one for the 2.4kv emergency transfer switch).			
									Ground detectors are indicating lights.			
									Note: All primary and secondary breakers and bus ties will be operated by Utilities Section.			

## Revision Record

Date	Page	Step #	MOC#	Comments
10/25/01	All			Original Issue.
10/25/01	5	9456	F-1100A, F-1100B, F-1100 - Fuel Gas Pressure - Set point changed.	
01/15/02	Furn ace Sect on	7580, 7588, 7591, 7593, 9456, 9478	NOx Project modifications - Ultra low NOx burners. Fuel gas pressure setting. K-1186 Fuel gas controller, Bridgeview temp and CO.	
2/25/02	All	Clarification		
12/17/02		10075	Nox Updates	
05/20/03			Inserted 4 Crude 14 psig into from section 12 (Inhibit shooting guide)	
5/28/03		12001	F-1160 11T1605 F-1160 950 steam outlet temperature alarm set to 750°F.	
10/19/03	7	12001	F-1160 11T1605 F-1160 50% steam upper limit set to 860°F max.	
10/27/03		12001	Changed F-1160 11T1605 Upper Limit from 705°F to 860°F	
10/27/03		12250	Added Feed Pump Motor Amp Info	
10/28/03		n/a	Re-arranged variable & equipment content for Feed Pump Motor Amp Info	
11/3/03		n/a	Corrected typo in Motor amp section	
11/3/03		12457	Added Y-1103dP Alarm Info	
11/24/03		12517	Increased C-1160 OH temp to 100°F.	
7/14/04		13462	11FC182 Hot Crude Recycle Line	
2/18/08		N/A	Added information to complete table per SME review.	
6/11/09		19892	H2 Purify TIC V-711 Wild Naphtha Routing From NFT to JHT into added to Corrective Action for 11PC015 upper limit	

D&R Division      Consequence of Deviation

PROCESS VARIABLE	EQUIPMENT DESCRIPTION	COMMENTS	NORMAL RANGE	UPPER LIMIT	LOWER LIMIT	CONSEQUENCE OF DEVIATION	PROBABLE CAUSE	CORRECTIVE ACTION
C-1180, And Description	C-1180, Level	N/A.	50%	80%	20%	Loss of F-1180 pumps.	Water level too low.	Check level controller and restart pumps.
11HV0132	Furnace chopper valve.	Valve position 11-24-0132 open	100%	100%	Debris is non-operational.	Loss of benzene flow from Debra to furnace.	Re-set and open chopper valve (11-HV-0127).	
V1 thru V6	Carbon Filters.	Two in service at a time.	N/A	High (xxx psig)	N/A	Low flow through the skirt and a back up at Debra.	Carbon filters plugging	Switch to fresh set of filters.
Carbon Drums 1-6.	Bag Filters.	One in service at a time.	N/A	High (xxx psig)	N/A	Bag Filters over pressure, causing the Bag Filters plugging with sediment. Bypassing the filter bypass to chopp.	Switch to fresh Bag Filter and change out the plugged filter.	
K-3140A/B								

**Revision Record**

Date	Page	Step #	MOC#	Comments
2/25/08	All		NA	Original issue of this document. Extracted from 4 Crude Unit COD to past separately under its own heading.

**Richmond RPM XANS Repeater Report**

Plant: 4CU

Previous -2000 Days

CPVs with Excursions

**SAFETY**

4CU	State Count	Total Duration	Current Value			While Active		
			Pct	To Lim	Hi Lim	Min	Max	Avg
<b>F-1100A</b>								
11HS111 - F1100A MIN FIRE B/P	High	31 19d 11h53m 1%	0	0.1	0	1	0.89	-
11XA002D - F1100A CHOPPERS BYPASSD	High	38 3d 16h46m 0%	0	0.1	0	1	0.42	-
<b>F-1100B</b>								
11HS211 - F1100B MIN FIRE B/P	High	23 2d 21h32m 0%	0	0.1	0	1	0.26	-
11XA012D - F1100B CHOPPERS BYPASSD	High	26 3d 00h22m 0%	0	0.1	0	1	0.287	-
<b>F-1160</b>								
11HS622 - F1160 MIN FIRE B/P	High	32 5d 09h50m 0%	0	0.1	0	1	0.6	-
11XA062D - F1160 CHOPPERS BYPASSED	High	33 4d 02h43m 0%	0	0.1	0	1	0.477	-

#4 CI - Unit PHA - External Events Worksheet  
 Participants: Ben Purvis, Jacque Cartier, Mark Crow, Sean J. Negron

J-11-09

Event	Notes & Comments	Basic Safeguards Employed for all Covered Processes	Additional Measures taken for stored LPG and H2S including Railcar Storage
Nearby Pipeline Accident	Site specific (nearby pipelines): unconfined vapor cloud explosions (VCE), spreading pool fires, and toxic chemical release could impact facility operations.	<ul style="list-style-type: none"> <li>○ Isolate &amp; deny entry into area</li> <li>○ Proper Personnel Protective Equipment (PPE) per procedures</li> <li>○ Evacuation and Shelter-in-place plans</li> <li>○ Fixed fire water spray throughout units</li> </ul>	
Release of Chemicals	Toxic chemicals may impair operations.	<ul style="list-style-type: none"> <li>○ Scott airpacks near control rooms</li> <li>○ Personal H2S monitors</li> <li>○ Evacuation and Shelter-in-place plans</li> </ul>	
Sabotage	Disgruntled employees may deliberately damage or destroy vital plant systems.	<ul style="list-style-type: none"> <li>○ Security Access – Badge system</li> <li>○ Surveillance</li> </ul>	
Terrorist	Recommend following Security & Vulnerability Assessment Guidelines	<ul style="list-style-type: none"> <li>○ Security Access – Badge system</li> <li>○ Surveillance</li> </ul>	
Seismic Activity	Recommend following the Seismic Assessment Guidelines	<ul style="list-style-type: none"> <li>○ Seismic walkthrough of each facility in accordance with the current PHA schedule. Qualified Operator and Civil Engineer performs visual inspections of the following:                             <ul style="list-style-type: none"> <li>○ Structural Steel</li> <li>○ Concrete structures</li> <li>○ Anchor bolts and</li> </ul> </li> </ul>	

#4 C:\Unit PHA - External Events Worksheet  
Participants: Ben Purvis, Jacque Cartier, Mark Crow, Sean J. Negron

11-09

		<ul style="list-style-type: none"> <li>○ Concrete foundations</li> <li>○ Operator walkthrough of plants after notable seismic activity</li> <li>○ For new or modified facilities Design standards and codes employed for this region</li> </ul>
Transportation Accidents	Site specific; an accident on a major highway or airplane crash may cause evacuation of plant site; an accident at the facility may damage vital equipment	<ul style="list-style-type: none"> <li>○ Traffic plan developed</li> <li>○ Barricades strategically placed</li> <li>○ Refinery in no-fly zone</li> </ul>
Maintenance Activities	Review forklift and crane traffic potential for equipment damage during movement or lifting operations.	
External Flooding/Landslides	Review rivers, lakes, streams and storm water drainage locations for potential impacts to the facility.	
Extreme Winds	Site specific; review equipment design for service in extreme winds.	<ul style="list-style-type: none"> <li>○ The refinery has been designed to the California Building Code (Uniform Building Code) requirements for wind design</li> </ul>
Fire	Review locations of flammable material containing systems near process site; gasoline storage, fuel oil, wild fire potential, etc.	<ul style="list-style-type: none"> <li>○ Trained Plant Protection Personnel in the facility</li> <li>○ Local and agency audits</li> <li>○ Operate per Hazardous Materials Business Plan</li> </ul>
Fog	Presence of fog may increase the frequency of incidents.	<ul style="list-style-type: none"> <li>○ Follow basic safety rules of driving</li> <li>○ Security personnel enforce traffic rules</li> </ul>
High/Low	Review impact on vapor pressure	

#4 CI. Unit PHA - External Events Worksheet  
Participants: Ben Purvis, Jacque Cartier, Mark Crow, Sean J. Negron

4-11-09

Temperatures	of chemicals in storage systems. Review susceptibility of equipment to freezing.	
Internal Flooding	Review failure of any large water storage tank on plant site; blockage of storm water sewers.	<ul style="list-style-type: none"><li>○ Work with Operating areas and EOD on damming and diversion.</li><li>○ Institute traffic plan</li></ul>
Labor Disruption	Site impact & mitigation measures	<ul style="list-style-type: none"><li>○ If qualified operators not present, unit will be shutdown.</li></ul>

ABU: D&R Plant Name(s): #4 Crude Unit/DEBRU  
 Compliance due date (Must be completed by): 9/23/2010  
 Methodology Employed: Hazop X, What-if X, Procedural PHA  , Other (specify and document justification):    
 Hazard Assessments Type : Initial PHA   PHA Revalidation   PHA Re-do X

Item	Activities	Org / Person	Comp By
<b>Planning Activities</b>			
<b>Scheduling</b>			
1	Perform quality review of previous PHA document using ETC Guidelines	PSMC / Facilitator	MXEW
2	Request that the ABU review EOM, P&ID's, PFD's and verify that they are current and accurate	HES / Facilitator	MXEW
3	Schedule Kick-off Meeting with ABU	HES / Facilitator	MXEW
4	Reserve Conference Room	HES / Facilitator	MXEW
5	Identify and Notify PHA Facilitator	HES / Facilitator	MXEW
6	Identify and Notify LC Facilitator	HES / Facilitator	MXEW
7	Identify and Notify ISS Facilitator	HES / Facilitator	MXEW
8	Identify and Notify BIN Team Leader / SME	HES / Facilitator	MXEW
9	Identify and Notify Seismic Facilitator	HES / Facilitator	TSFX
10	Schedule Seismic Review	HES / Facilitator	TSFX
11	Schedule Pre-Assessment Review	HES / Facilitator	TSFX
12	Schedule Latent Condition Review	HES / Facilitator	MXEW
13	Schedule PHA/Revalidation Team Meetings	HES / Facilitator	MXEW
14	Schedule Inherently Safer Review (if required)	HES / Facilitator	MXEW
15	Schedule Close-out Meeting with Management	HES / Facilitator	MXEW
<b>Kick-Off Meeting</b>			
16	Facilitate Kick-Off Meeting with ABU Management	HES / Facilitator	MXEW
17	Review schedule of activities with ABU	HES / Facilitator	MXEW
18	Agree on hazard assessment type and scope - re-validation or re-do	HES / Facilitator	MXEW
19	Review operating and technical manpower requirements with ABU - Gain agreement on qualifications. to provide individuals names within 10 days	ABU HES / Facilitator	MXEW
20	Request that the ABU gather concerns from the directly affected personnel prior to the pre-assessment	HES / Facilitator	MXEW
21	Request that the ABU gather plant specific reliability concerns from M&R group prior to the pre-assessment	HES / Facilitator	MXEW
22	Request that the ABU identify any unique/specialty equipment in the plant	HES / Facilitator	MXEW
<b>Study Preparation</b>			
23	Prepare working copy of previous PHA for revalidating	HES / Facilitator	MXEW
24	Prepare list of MOC's from the previous 5 year period	HES / Facilitator	MXEW
25	Prepare list of Incident Investigations from the previous 5 year period	HES / Facilitator	MXEW
26	Obtain report of previous PHA A/C's, resolution plan and status. If not previously done, field verify as complete.	HES / Facilitator	MXEW
27	Request input/participation from the BIN Team Leader and/or Subject Matter Experts	HES / Facilitator	MXEW
28	Obtain Plant Hazard Information from EOM	HES / Facilitator	MXEW
29	Obtain list of current plant Consequences of Deviation Tables	HES / Facilitator	MXEW
30	Prepare list of current plant Safety Critical Process Variables with exceptions reported for the past 5 years	HES / Facilitator	MXEW
31	Prepare "Process Plant Building Hazard Analysis Checklist"	HES / Facilitator	MXEW
32	Resend meeting invitations to all when confirmed by ABUM	HES / Facilitator	MXEW
<b>Hazard Assessment Activities</b>			
<b>Seismic Review</b>			
33	Perform walkthrough with Operator	Technical / Engineer	FATE
34	Provide summary of findings with recommendations to ABU and PHA Facilitator	Technical / Engineer	FATE
35	Provide detailed worksheets to PHA facilitator	Technical / Engineer	FATE
<b>PHA Pre-Assessment</b>			
36	Ensure all team members attend	Assets / ABUM	SIPR
37	Ensure participants have filled out a statement of competency to participate in the evaluation	HES / Facilitator	MXEW
38	Bring all documentation to the team meetings (Seismic, Siting, LC, A/C status, P&ID's, PFD's, etc).	HES / Facilitator	MXEW
39	Review the design intention of each section within the previous PHA and discuss previous A/C's	Facilitator / Team	MXEW
40	Review MOC history over the past five years	Facilitator / Team	MXEW
41	Review Incident Investigations and corrective actions over the last five years	Facilitator / Team	MXEW
42	Review current Reliability concerns	Facilitator / Team	MXEW
43	Review the concerns of directly affected personnel	Facilitator / Team	MXEW
44	Review the Critical Process Variables and exceptions	Facilitator / Team	MXEW
45	Review BIN Team and/or Subject Matter Expert issues	Facilitator / Team	MXEW
46	Review the Seismic and Siting reports	Facilitator / Team	MXEW
47	Confirm appropriate methodology to be used during the PHA revalidation	Facilitator / Team	MXEW
48	Develop and document section titles	Facilitator / Team	MXEW
49	Identify the sections that require review and updating	Facilitator / Team	MXEW

ABU: D&R Plant Name(s): #4 Crude/DEBRU  
 Compliance due date (Must be completed by): 9/23/2010  
 Methodology Employed: Hazop X, What-if X, Procedural PHA  , Other (specify and document justification): \_\_\_\_\_  
 Hazard Assessments Type : Initial PHA   PHA Revalidation   PHA Re-do X

Item	Activities	Org / Person	Comp By
<b>Latent Conditions Review Activities</b>			
50	Ensure required team members attend	Assets / ABUM	SIPR
51	Train team members, complete training log and obtain signatures	HES / Facilitator	MXEW
52	Perform assessment using Latent Conditions checklist	Facilitator / Team	MXEW
53	Develop report including team findings	HES / Facilitator	MXEW
54	Participants review and certify that the checklist reflects the current situation	Facilitator / Team	MXEW
<b>PHA Revalidation Activities</b>			
55	Ensure all team members attend	Assets / ABUM	SIPR
56	Train team members, complete training log and obtain signatures	HES / Facilitator	MXEW
57	Update previous PHA to reflect current configuration and status of the plant	Facilitator / Team	MXEW
58	Ensure previous A/C's (if completed) are included as safeguards and re-rank.	Facilitator / Team	MXEW
59	Risk Rank all items reviewed.	Facilitator / Team	MXEW
60	Develop additional considerations to reduce the severity and/or likelihood of incidents	Facilitator / Team	MXEW
61	Communicate A/C's that will require ISS reviews <b>Immediately</b> to the ABU	Facilitator / Team	MXEW
62	Develop report including team findings	HES / Facilitator	MXEW
<b>Inherently Safer Systems Review Activities</b>			
63	Ensure required team members attend	Assets / ABUM	SIPR
64	Train team members, complete training log and obtain signatures	HES / Facilitator	MXEW
65	Perform section-by section review using PFD's and the ISS checklist	Facilitator / Team	MXEW
66	Develop report including team findings	HES / Facilitator	MXEW
<b>Close-out Meeting Activities</b>			
67	Communicate PHA, LC, Seismic, ISS and Siting findings to ABU management	HES / Facilitator	MXEW
68	Communicate the expectations for the resolution of hazards	HES / Facilitator	MXEW
69	Develop a resolution plan from each finding	Assets / ABUM	SIPR
70	Provide overview on how findings are communicated	HES / Facilitator	MXEW
71	Identify the audience to receive communication of findings	Assets / ABUM	MXEW
72	Develop communication plan and identify the directly affected personnel	ABUM / Facilitator	MXEW
<b>Certification</b>			
73	Certification that management has reviewed the completed checklists used during these evaluations and that they were applied properly. Certified and dated by ABU Manager and PHA Facilitator as complete.	ABUM <i>Carden</i> Facilitator <i>Mark Goss</i>	
74	Audited by: (optional)	HES / PSMC	
<b>Wrapup Activities</b>			
75	Finalize reports	HES / Facilitator	MXEW
76	Enter all Additional Considerations and/or recommendations from PHA, LC, ISS, Siting and Seismic reviews into appropriate databases with owners and due dates	HES / Facilitator	MXEW
77	Create Adobe Acrobat file of PHA Section Listing and Worksheets and place link on PHA Findings web page	HES / Facilitator	MXEW
78	Request communications package(s) and due date be entered into Active Learner	HES / Facilitator	MXEW
79	Ensure that the PHA report includes a narrative report with the revalidation team meeting completion date, draft report date and due date of next revalidation; PHA A/Cs, LC, Seismic, ISS and Siting recommendations developed by the team; MOCs, Incidents, Previous A/Cs, BIM/SME input, Crew input, Reliability Group input, Plant Hazard information, COD tables, CPVs, and External Events reviewed by the team; signed PHA Task checklist; names and qualifications of team members, signed training logs and training material; Siting, Seismic, LC, ISS review documentation; PHA Section Listing and PHA Worksheets; drawings used in the reviews and the communication plan	HES / Facilitator	<i>M. Goss</i>
80	Place paper copy of initial PHA for new facilities or revalidated PHAs for existing facilities in ESD library. Put all electronic files on the refinery shared server in the O:\PSMMod-only\PHA files folder <i>(Prior PHA's may be sent to Dublin for storage)</i> DOCUMENTATION SHALL BE RETAINED FOR THE LIFE OF THE PROCESS	HES / Facilitator	<i>M. Goss</i>

Revised: November 2, 2007

## Richmond Refinery

### Statement of Competency to Participate in Hazard Assessments, Evaluations, Audits or Investigations

--- Note: One form is required for each participant ---

**NAME:**

**R. L. SPROUSE**

**1) Role as Participant: Check all that apply:**

- Design Engineer,
- Process Engineer,
- Operations Representative,
- Process Master/Expert,
- Management Representative,
- Maintenance Representative,
- Trained Process Hazards Analysis Facilitator,
- Trained Latent Conditions Facilitator,
- Trained Inherently Safer Solutions Facilitator,
- Participant knowledgeable in the process involved,
- Trained Tap Root® Facilitator
- Trained PSM Audit Facilitator
- Contractor: If involved in a Tap Root® Investigation,
- Other person with appropriate knowledge and experience to thoroughly investigate and analyze an incident,
- Other: \_\_\_\_\_

**3) Please document the extent that you are familiar or qualified to participate in these assessments include years of experience:**

Training: in house Hazard training, participation in past Hazops

Education: B.S. Chemical Engineering

Other Relevant Experience: 37 years experience in refining process design & operations with focus on crude distillation

**4) CAI**

Date:

RLSP

8/71/09

**Richmond Refinery**  
**Statement of Competency to Participate in Hazard Assessments, Evaluations, Audits or**  
**Investigations**

--- Note: One form is required for each participant ---

**NAME:** Ben Purvis

1) Role as Participant: Check all that apply:

- Design Engineer,  
 Process Engineer,  
 Operations Representative,  
 Process Master/Expert,  
 Management Representative,  
 Maintenance Representative,  
 Trained Process Hazards Analysis Facilitator,  
 Trained Latent Conditions Facilitator,  
 Trained Inherently Safer Solutions Facilitator,  
 Participant knowledgeable in the process involved,  
 Trained Tap Root® Facilitator  
 Trained PSM Audit Facilitator  
 Contractor: If involved in a Tap Root® Investigation,  
 Other person with appropriate knowledge and experience to thoroughly investigate and analyze an incident,  
 Other: \_\_\_\_\_

3) Please document the extent that you are familiar or qualified to participate in these assessments include years of experience:

Training: Crude Unit training, Distillation training

Education: Masters in Chemical Engineering

Other Relevant Experience: 3 years as process engineer on other units

4) CAI  
Date:

BPCQ

8/31/09

**Richmond Refinery**  
**Statement of Competency to Participate in Hazard Assessments, Evaluations, Audits or**  
**Investigations**

--- Note: One form is required for each participant ---

**NAME:**

Jacques-Michael Cartier

1) Role as Participant: Check all that apply:

- Design Engineer,
- Process Engineer,
- Operations Representative,
- Process Master/Expert,
- Management Representative,
- Maintenance Representative,
- Trained Process Hazards Analysis Facilitator,
- Trained Latent Conditions Facilitator,
- Trained Inherently Safer Solutions Facilitator,
- Participant knowledgeable in the process involved,
- Trained Tap Root® Facilitator
- Trained PSM Audit Facilitator
- Contractor: If involved in a Tap Root® Investigation,
- Other person with appropriate knowledge and experience to thoroughly investigate and analyze an incident,
- Other: \_\_\_\_\_

3) Please document the extent that you are familiar or qualified to participate in these assessments include years of experience:

Training: 11 years refining

Education: HS grad

Other Relevant Experience: 6 yrs Navy Nuclear Power 2 year radiation protection  
7+ years commercial nuclear power

4) CAI

Date:

CASS

8/31/09

## Richmond Refinery

### Statement of Competency to Participate in Hazard Assessments, Evaluations, Audits or Investigations

--- Note: One form is required for each participant ---

NAME: Benjamin Hulse

1) Role as Participant: Check all that apply:

- Design Engineer,
- Process Engineer,
- Operations Representative,
- Process Master/Expert,
- Management Representative,
- Maintenance Representative,
- Trained Process Hazards Analysis Facilitator,
- Trained Latent Conditions Facilitator,
- Trained Inherently Safer Solutions Facilitator,
- Participant knowledgeable in the process involved,
- Trained Tap Root® Facilitator
- Trained PSM Audit Facilitator
- Contractor: If involved in a Tap Root® Investigation,
- Other person with appropriate knowledge and experience to thoroughly investigate and analyze an incident,
- Other: \_\_\_\_\_

3) Please document the extent that you are familiar or qualified to participate in these assessments include years of experience:

Training: ASME B31.1, B31.3, Section VIII, CTU

Education: BSME, UC Berkeley

Other Relevant Experience: 4 years as design engineer in Distillation & Reforming.

4) CAI

Date:

BHUL

08/31/09

**Richmond Refinery**  
**Statement of Competency to Participate in Hazard Assessments, Evaluations, Audits or**  
**Investigations**

--- Note: One form is required for each participant ---

NAME:	Mark Crow (MXEW)
-------	------------------

1) Role as Participant: Check all that apply:

- Design Engineer,
- Process Engineer,
- Operations Representative,
- Process Master/Expert,
- Management Representative,
- Maintenance Representative,
- Trained Process Hazards Analysis Facilitator,
- Trained Latent Conditions Facilitator,
- Trained Inherently Safer Solutions Facilitator,
- Participant knowledgeable in the process involved,
- Trained Tap Root® Facilitator
- Trained PSM Audit Facilitator
- Contractor: If involved in a Tap Root® Investigation,
- Other person with appropriate knowledge and experience to thoroughly investigate and analyze an incident,
- Other: \_\_\_\_\_

3) Please document the extent that you are familiar or qualified to participate in these assessments include years of experience:

Training: ABS PHA Leadership Course - 2007, Certification Award - 2008

COR ISO Training - LC and ISS - 2009

Education: BS - Chemical Engineering

Other Relevant Experience: 12 Yrs Chemical Operation Management - DuPont

3 Yrs PHA Facilitator - Refinery Operations - Siemens

4) CAI  
Date: MXEW  
3/1/10

**CHEVRON RICHMOND REFINERY  
QUALIFICATION COMPLETION LOG**

H4 Crude PHA Training 8/31/08  
Qualification Description (s)

Qualification Description (s) Qualification Code (s)

—

Instructor - Print Name

Instructor - Signature

### # of Hours

I CERTIFY THAT THE LISTED EMPLOYEES HAVE RECEIVED TRAINING AND COMPETENCY TESTING

卷之三

I attended the training described above on:

**CHEVRON RICHMOND REFINERY  
QUALIFICATION COMPLETION LOG**

#4 Cricke LC Training 8/31/09

### Qualification Description (s)

卷之三

Instructor - Print Name

Instructor - Signature

### # of Hours

I CERTIFY THAT THE LISTED EMPLOYEES HAVE RECEIVED TRAINING AND COMPETENCY TESTING

卷之三

I attended the training described above on:

POP Administrator Use Only

Qualification ID#

Date Entered

**CHEVRON RICHMOND REFINERY  
QUALIFICATION COMPLETION LOG**

#4 Crude - ISS Trauma 8/31/09  
Qualification Description (s)

Qualification Description (S) Qualification Code (S)

卷之三

*Madame de Staélle*

M. C. S.

Instructor - Print Name

### Instructor - Signature

# of Hours

I CERTIFY THAT THE LISTED EMPLOYEES HAVE RECEIVED TRAINING AND COMPETENCY TESTING

THE JOURNAL OF CLIMATE

Your attendance must be documented. Please print your name, CAI, sign your name and indicate your abu or department and section.

I attended the training described above on

POD Administrator Use Only

Classification ID:

Date Entered

## Crow, Mark A (MXEW)

---

**From:** Crow, Mark A (MXEW)  
**sent:** Friday, March 26, 2010 3:23 PM  
**To:** Vodenik, Diane (DMVO)  
**Cc:** Preciado, Silvano (SIPR); Smith, Joseph (JoeSmith)  
**Subject:** D&R #4 Crude Compliance Review Findings: Communications Package

Diane,

Please enter the following communications into the Active Learner database with a due date of 6/30/2010:

### D&R #4 Crude Unit Compliance Review Findings:

D&R #4 Crude Unit 2009 PHA Recommendations: Total 29

<http://ric841ntg3web10.ric841.chevrontexaco.net/asppha/PHASectionitm.asp?ABU=D%26R&Plant=%234+Crude+Unit&vt=2009>

D&R #4 Crude Unit 2009 Latent Condition Findings: Total 5

<http://ric841ntg3web10.ric841.chevrontexaco.net/aspLC/LCFindings.asp?ABU=D%26R&Plant=%234+CRUDE+UNIT&FType=1>

D&R #4 Crude Unit 2009 Inherently Safer Systems Findings: Total 3

<http://ric841ntg3web10.ric841.chevrontexaco.net/aspLC/LCFindings.asp?ABU=D%26R&Plant=%234+CRUDE+UNIT&FType=3>

D&R #4 Crude Unit 2009 Seismic Findings: Total 25

<http://ric841ntg3web10.ric841.chevrontexaco.net/aspLC/LCFindings.asp?ABU=D%26R&Plant=%234+CRUDE+UNIT&FType=2>

The communication packages should be assigned to:

- D&R Crude A Operators  
- D&R Crude B Operators

- D&R Maintenance Personnel

Carver, MJ
Chavez G
Clifford, R
Doolin, EA
Garrett, B
Karbone, MJ
Nelson, JM
Ochoa, M
Pater, M
Shin, C
Weaver, BA

R&R #4 Crude PHA Facilitator  
Mark Crow (MXEW)

Please include a request at the end of the PHA Findings training for the individual to provide feedback to the PSM Coordinator on the communication package by using the "Employee Feedback" link on the "Findings" web page. The feedback request is not required for the Latent Conditions, Seismic or ISS Findings

Thank you,

**Mark Crow**  
PSM Specialist / PHA Facilitator  
Richmond Refinery  
Chevron Products Company  
841 Chevron Way, T/C 333  
Richmond, CA 94802  
T)510-242-2071 F) 510-242-5353

Process Plant Buildings Hazards Analysis  
Checklist per API RP-752 Methodology



**Chevron**

Richmond Refinery

BUILDING NAME:	D&R/LSFO Control House	Location:	#4 Crude Unit
Review Date:	Nov. 11, 2009	Prepared by:	
Checklist Questions		Y/N/NA	Reference/Comments
<b>BUILDING STRUCTURE</b>			
Is the building structure lateral design sufficient to withstand the predicted overpressure resulting from the largest credible modeled vapor cloud explosion, earthquake or wind gust, without serious personnel injury or damage to safety critical equipment?		Y	All buildings are in compliance with API RP-752.
If the building is occupied and exposed to a modeled vapor cloud explosion, are building windows coated to prevent glass fragmentation?		N/A	No windows in building.
Are ceiling fixtures, furnishings, filing cabinets & battery racks, etc., adequately anchored in the event of a blast or seismic event?		N	Some items in control house not currently anchored (filing cabinets, vending machines)
<b>FIRE HAZARD</b>			
If the building meets minimum occupancy requirements, is it sited more than 50 feet from a process plant or pipeway containing hydrocarbons? If not, has the building had a HAZOP type Risk Assessment completed with the recommendations implemented?		N Y	All buildings are in compliance with API RP-752.
Are there any atmospheric vents which may contain toxic or flammable vapors located within 50 feet of the building?		N	Not a concern; no such vents within 50 feet of control house.
For occupied buildings, does the structure include multiple egress routes for personnel in case a fire occurs adjacent to the structure?		Y	
Are building sewer systems segregated from process sewer systems to prevent ingress of flammable or toxic vapors, and is the building not located in the drainage path of flammable liquids?		Y Y	
Is the building equipped with a fire suppression system appropriate to the building function and the material/equipment located in the building?		Y	
<b>TOXIC RELEASE</b>			
Are building Emergency Action Plans clearly posted, with annual scheduled drills, and reviewed with personnel?		Y	
If the building is designated as Shelter-In-Place, is there a means to rapidly shutdown the ventilation system?		Y	
If the building is designated as Shelter-In-Place, have all penetrations through the roof, walls and sub-flooring been sealed?		Y	
For occupied buildings, is there a 1-D emergency network speaker system installed to rapidly warn and advise occupants?		Y	
If occupancy of the building is required for the safe shutdown of an operating plant, is there adequate personnel protective equipment to handle emergencies that could reasonably be expected to occur?		N	Concern is that there are insufficient Scott airpacks to protect all required personnel. Addressed in Latent Conditions Assessment, Item 4-58.

Y = Concern raised by the question has already been addressed. No further documentation is required.

N = Concern raised by the question has not already been addressed. Further analysis and documentation are required.  
The PHA team should fully develop the concern using the approved What-If method.

NA = Concern raised by the question is not applicable for the area under consideration.

# Process Hazards

## Analysis Checklist: Process Plant Buildings

Review Date:		Unit/Project:	
Location:		MOC#:	
Checklist Questions		Y/N/NA	Reference/Comments

Note: All refinery buildings were brought into compliance with API RP-752 in March 2002.

See the PSM Team Leader in the HES division for documentation on all refinery buildings

Checklist Revised: 9/28/2006



## Memorandum

To: Carl Simmers  
From: Technical Department  
Date: August 28, 2009  
Re: Summary of Seismic Review

This review was performed to meet the requirements of the California Accidental Release Prevention Program. The seismic review and impact of external events walkthrough of #4 Crude Unit was performed August 19 and 27, 2009. The review was performed by a registered professional civil engineer and operator familiar with the equipment and structures contained within the plant. The review focused on four main areas: 1) a review of structural steel, 2) review of concrete structures, 3) review of anchor bolts, and 4) review of concrete foundations. The review was done by the use of a checklist.

The engineer has the following recommendations:

Area	Observation *	Recommendation	For	Action taken
V1190	Spalled concrete & corroded rebar on pedestal column. 8/19-pic 1	Remove loose concrete near rebar and repair concrete. Notify engineer if corroded rebar diameter is less than 90% of original.	Gerald Lee II	
V1190	North end ladder missing anchor bolt. 8/19-pic 5	Install equal size anc bolt 1.5" left. Use Simpson Strong Bolt or Hilti Kwik Bolt TZ embed 3".		
E1107 A/B	Anchor bolt nuts too high. 8/19-pic 6	Run nuts down.		
E1107 A/B	Spalled concrete north end pedestal. 8/19-pic 7	Repair concrete.		
E1106	Cracked pedestal and missing grout. 8/19-pic 8	Expose rebar at crack & check for corrosion. Notify engineer if corroded rebar diameter is less than 90% of original. Repair concrete and grout.		
E1103	North end anchor bolts too high. 8/19-pic 9	Run nuts down.		



V1103	Cracks in fireproofing at junction with insulation-possible corrosion. 8/19-pic 10	Remove fireproofing in small spots, check for corrosion & repair fireproofing.		
Fin Fans	Tension brace cut & used as pipe support. 8/19-pic 11	Provide bracing. Consider reroute of pipe.		
Fin Fans	Badly cracked fireproofing at base of many fin fan columns. 8/19-pics 12 through 15	Replace fireproofing using reinforcing wire mesh to keep it intact.		
V1100 Deck Structure	Fireproofing missing at junction of two beams at NW-corner. 8/19 pic 16	Remove some of the fireproofing, check for corrosion of the structural steel & replace fireproofing.		
Structural Columns near V1104	Cracked and spalling fireproofing. 8/27-pics 1 through 3	Remove some fireproofing to check for corrosion, replace same & repair cracks.		
C1104	Spalled fireproofing at base. 8/27-pic 4	Remove some fireproofing to check for corrosion & replace same.	Gerald Lee II	
C1140	Spalled fireproofing at base. 8/27-pic 5	Remove some fireproofing to check for corrosion & replace same.		
F1100B F1160	Cracked and spalled concrete at anchor bolts. 8/27-pics 6 through 11	Repair concrete.		
V1160 A/B	Missing bolts. 8/27-pic 12	Install bolts.		
C1160 Transfer Line	Vibrating brace. 8/27-pic 13	Inspect brace. Adjust or replace as required.		
E1188	South end anchor bolt nuts too high. 8/27-pic 14	Run nuts down.		
E1165B	South end anchor bolts missing. 8/27-pic 15	Install bolts.		
E1110B	North end anchor bolts loose. 8/27-pic 16	Tighten anchor bolts.		
E1109	South end anchor bolts too high. 8/27-pic 17	Run nuts down.		



E1108C	North end anchor bolt nuts high. 8/27-pic 18	Run nuts down.	Gerald Lee II	
E1113	South end anchor bolt nuts too high. 8/27-pic 19	Run nuts down.		
E1115	South end anchor bolt nuts too high. 8/27-pic 20	Run nuts down.		
E1116B	South end anchor bolts loose. 8/27-pic 21	Tighten bolts.		
V1198	Inadequate nut to anchor bolt engagement both ends, 8/27-pics 22 & 23	Replace existing nuts with Elocone nuts or equivalent.		

\* Please see attachment for pictures.

It is recommended that a Work Order be generated to resolve the noted deficiencies.

A handwritten signature of "Al Greene" in black ink.

Al Greene, PE, SECB

Cc: Gerald Lee II  
Larry Savage  
Robin Tehrani-Saber  
Tom Farr  
Tim Storrs

w/attachment  
w/attachment  
w/attachment  
w/attachment  
w/attachment



Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: *J. A. Greene*

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-19-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: *V1190*

Summary of walkthrough:

- Adequate  
 Not Adequate  
 Further Evaluation Required

Recommendation:

*Repair conc. & inspect rebar by chipping  
away loose concrete near corroded rebar. Cont below*

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

*Elocone  
nuts are  
in place  
so these  
are OK  
as is. No  
work req'd.*

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

*Spalled concrete & corroded rebar. Pic 1*

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

*North end anc bolts recessed in nuts - Pics 2,3,4*

*" " ladder missing anc bolt & nut - Pic 5*

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

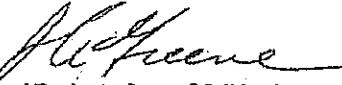
Notes by Engineer:

*Repair ladder anchor bolt by installing an  
equal size anc bolt 1/2" left. Use Simpson Strong  
Bolt or Hilti Kwik Bolt T2 embed 3" min.*

*Y/4*

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: 

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-19-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: V1109, E1107 A/B, E1123 A/B

Summary of walkthrough:

Adequate UNO

Not Adequate

Further Evaluation Required

Recommendation:

Run E1107 A/B and bolt nuts down. Repair conc  
north end.

south end

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

Spalled concrete north ped. E1107 A/B - pic 10?

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

South end E1107 A/B - nuts too high - pic 6

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

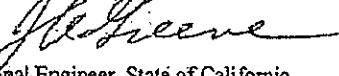
5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

Notes by Engineer:

2/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: 

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-19-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: E1106

Summary of walkthrough:

Adequate  
 Not Adequate  
 Further Evaluation Required

Recommendation:

*Expose rebar at crack & check for corrosion.  
Repair crack. Replace missing grout.*

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

*South ped - cracked conc & missing grout. - pic 8*

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

Notes by Engineer:

*3/14*

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: 

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-19-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: E1105 A/B, E1102 C, E1103, E1104

Summary of walkthrough:

- Adequate except as noted  
 Not Adequate  
 Further Evaluation Required

Recommendation:

E1103 north end - run nuts down.

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)
2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)  

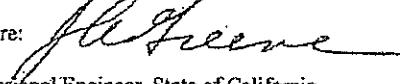
3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)  
*E1103 north end anch bolts too high - pic 9 - for the fixed end.*
4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)  


Notes by Engineer:

4/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: 

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-19-09

ABU: D & R

Plant: Nö. 4 Crude Unit

Equipment ID: V1103, T1108

Summary of walkthrough:

Adequate except as noted

Not Adequate

Further Evaluation Required

Recommendation:

in small spots

Remove fireproofing & check vessel walls for corrosion.

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

V1103 cracks in fireproofing at junction with insulation - possible corrosion. - Prc 10

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

3. Are the anchor bolts OK? (examples; is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

4. Is concrete foundation OK? (examples; is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

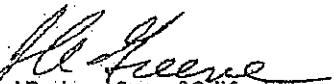
5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

Notes by Engineer:

5/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: 

Registered Professional Engineer State of California  
CIVIL No: 19659 Expires: 9-30-09

Date of walkthrough: 8-19-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: Fin Fans, E1149-1,2, E1119-75,1,2, E-1186-1,2, E1125-1,2

Summary of walkthrough: E1129-1,2, E1190E,1,2, E1190D,1,2, E1190C,1,2

Adequate except as noted      E1190B,1,2, E1190A,1,2, E1168-1,2  
 Not Adequate.      E1100F,1,2, E1100E,1,2, E1100D,1,2  
 Further Evaluation Required      E1100C-1,2, E1100B,1,2, E1100A,1,2

Recommendation:

Replace brace (pic 11). Replace grout & fire prfg using wire mesh (PIC 12,13,14,15) at min these places. Consider redoing all.

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

*MISSING brace 4th bay from west end, south side near E1119-75-1  
PIC 11*

Con't  
below

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

*Badly cracked grout & fireproofing near E1100F-1 (PIC 12), (PIC 13)  
near E1100D-1 (PIC 14), near E1100C-1 (PIC 15)*

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

5. Is wood OK? (examples; is there significant dry rot or splits?, are connections sound?)

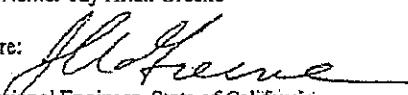
Notes by Engineer:

*At pic 11 location, reroute piping or rebrace structure.*

6/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: 

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-19-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: Atmospheric Structure, E1101 A,B,C,D, V1100

Summary of walkthrough:

- Adequate except as noted  
 Not Adequate  
 Further Evaluation Required

Recommendation:

Replace fire pfg & check for major corrosion.

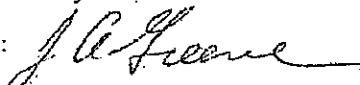
1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)  
*New end of V1100 deck fireproofing missing at junction of 2 beams. (Pic 16)*
2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)
3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)
4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)
5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

Notes by Engineer:

7/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: 

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-19-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: T-1104, Plot 1m, P-1167, V1102, P1180/A

Summary of walkthrough:

Adequate

Not Adequate

Further Evaluation Required

V1180, C1180, E1185, E1181

E1185 A/B, C1190, V1197, ~~V1198~~

Recommendation:

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

Notes by Engineer:

8/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: *J.A. Greene*

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-27-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: V1104, Col near V1104, C1100, C1120, C1140

Summary of walkthrough:

Adequate UNO

Not Adequate

Further Evaluation Required

Recommendation:

*Remove enough spalled fireproofing to check corrosion of underlying steel. Repair cracks epoxy jacket, Replace fireproofing.*

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

*Cracked & spalling fireproofing on cols near V1104, (pics 1,2,3).*

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

*Spalled fireproofing at base of V1104, Pic 4; base of C1140 (pic 5)*

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

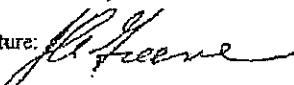
5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

Notes by Engineer:

9/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: 

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-27-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: F1100 B south & north boxes, F1100 A

Summary of walkthrough: north & south boxes, F1100

Adequate  
✓ Not Adequate  
Further Evaluation Required

Recommendation: Remove & replace spalled concrete.

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

✓

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

✓

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

✓

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

Cracked concrete F1100 B southwest corner pic 6; southeast corner (pic 7), northwest cor(pic 8), north east cor(pic 9),

5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

south east cor F1160 (pic 10), north east cor

Notes by Engineer: F1160 (pic 11)

10/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: J.A. Greene

Registered Professional Engineer State of California  
CIVIL No: 19658 Expires: 9-30-09

Date of walkthrough: 8-27-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: C1160, adjacent steel structure supporting

Summary of walkthrough: exchangers, V1160 A/B, E1162, E1161

Adequate V1160      V1177, C1160 transfer line, V1160  
 Not Adequate  
 Further Evaluation Required

Recommendation:

Install bolts at V1160 A/B. Inspect/evaluate brace on C1160 transfer line.

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

*MISSING bolts on V1160 A/B PIC 12. Vibrating brace on C1160 transfer line PIC 13.*

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

Notes by Engineer:

14/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: *J. Allan Greene*

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-27-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: E1188, E1166, E114B, E1178, E1165A/B

Summary of walkthrough:

Adequate *VNO*

Not Adequate

Further Evaluation Required

E1111, E1110 A/B, E1109, E110BC

Recommendation:

*Run nuts down E1128 south end, E1109 south, E110BC north, install zinc bolts E1165 south end. Tighten zinc bolts E1110B north end.*

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

*E1188 north nuts south end too high pic 14, MISSING zinc bolts south end E1165B(pic 15), Loose zinc bolts north,*

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

Notes by Engineer:

*end E1110B pic 16, High nuts south end E1109.*

*PIC 17, North end E1108C zinc bolt nuts high PIC 18.*

*12/14*

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: *J. Allan Greene*

Registered Professional Engineer State of California  
CIVIL No: 19655      Expires: 9-30-09

Date of walkthrough: 8-27-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: E1108 A/B, E1112, E1113, E1114, E1115

Summary of walkthrough:

Adequate ✓  
 Not Adequate  
 Further Evaluation Required

Recommendation: Run nuts down E1113 south end & E1115 south end,  
Tighten zinc bolts E1116 B south end.

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

✓

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

✓

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

E1113 south end anc bolt nuts high (pic 19) - 8 bolts,

4. E1115 south end anc bolt nuts high (pic 20)

E1115 south end anc bolt nuts high (pic 20)

4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

✓

5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

Notes by Engineer:

E1116 B south end loose zinc bolts (pic 21)

13/14

Walkthrough Criteria for Seismic & External Events

Engineer Printed Name: Jay Allan Greene

Engineer Signature: Jay Allan Greene

Registered Professional Engineer State of California  
CIVIL No: 19655 Expires: 9-30-09

Date of walkthrough: 8-27-09

ABU: D & R

Plant: No. 4 Crude Unit

Equipment ID: V1196, ~~V1198~~ V1169A, V1170

Summary of walkthrough:

Adequate V110  
 Not Adequate  
 Further Evaluation Required

V1169B, K1100 A/B, E1169A

K1171, V1175, V1171, V1198

Recommendation:

Replace nuts less than fully engaged with E100 caps.

1. Is the structural steel OK? (examples, is the steel skirt of a column damaged or are there signs of corrosion?, is there damage to a horizontal vessel saddle or exchanger saddle?, is the structural steel of a pipe way corroded or damaged?)

✓

2. Is the concrete of a concrete structure OK? (are there wide cracks in the concrete or massive spalling and exposure of reinforcement?)

✓

3. Are the anchor bolts OK? (examples, is there significant corrosion to the anchor bolts?, is there significant damage to the anchor bolts that may have occurred during maintenance activities?)

V1198 - inadequate nut/bolt engagement  
both ends PKS 22 & 23.

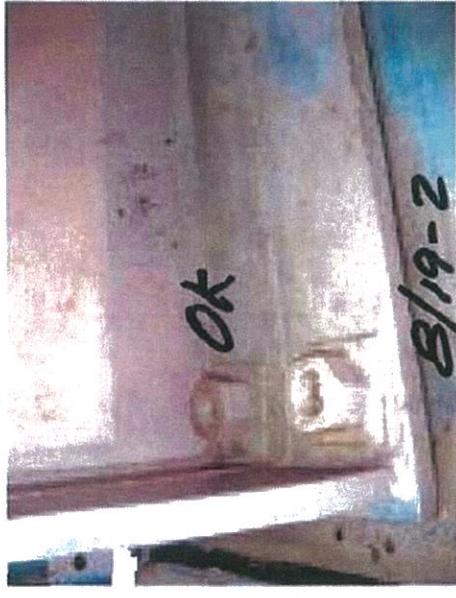
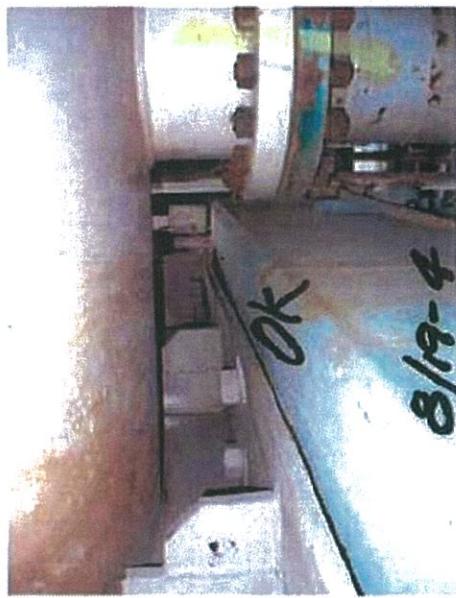
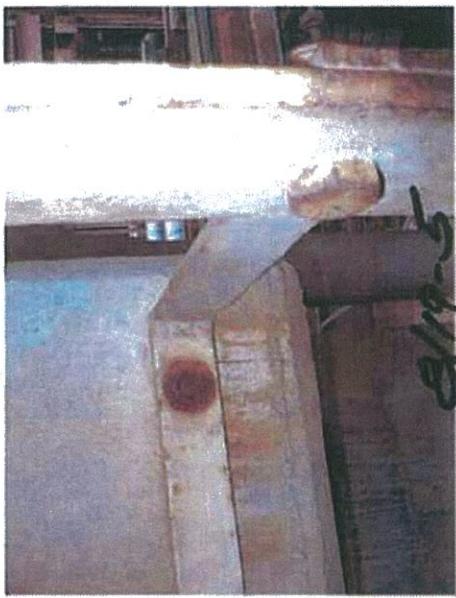
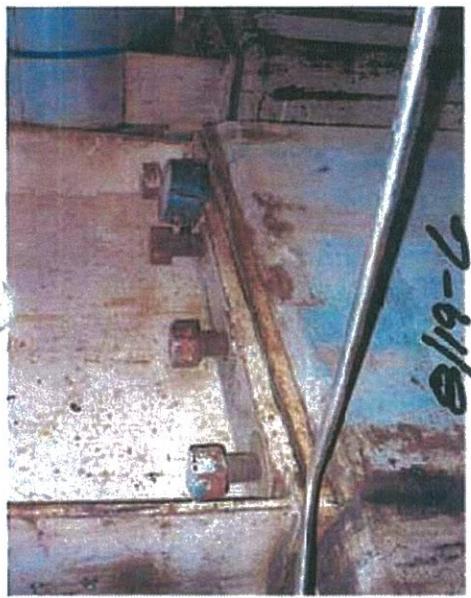
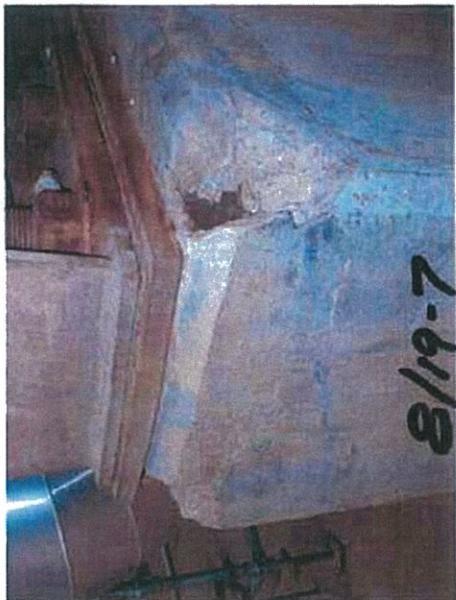
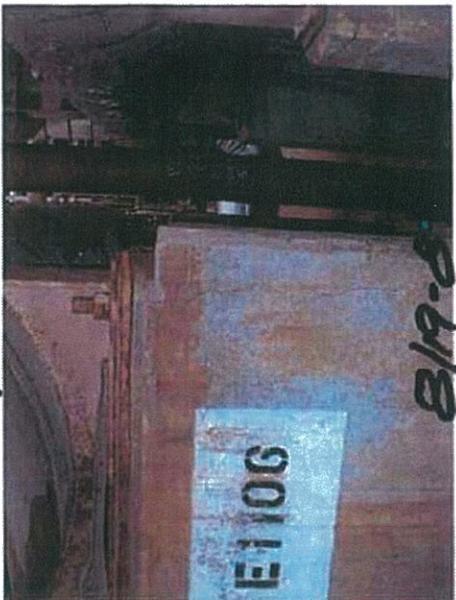
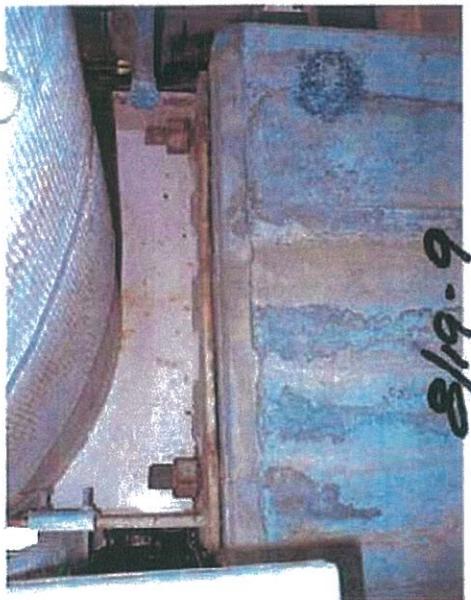
4. Is concrete foundation OK? (examples, is there significant deterioration of the concrete?, is the reinforcement exposed?, are there wide cracks in the concrete?, is there massive spalling of the concrete?)

✓

5. Is wood OK? (examples, is there significant dry rot or splits?, are connections sound?)

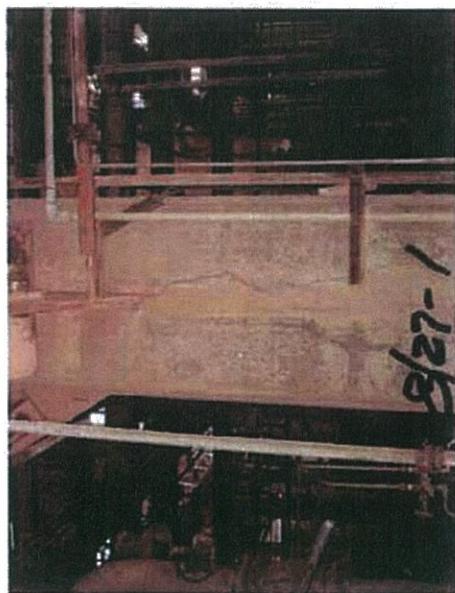
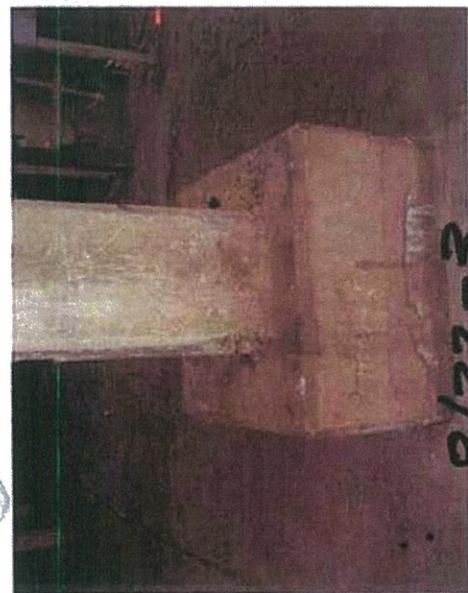
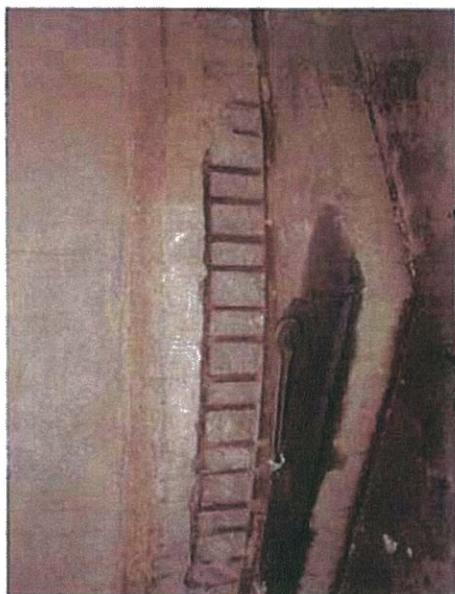
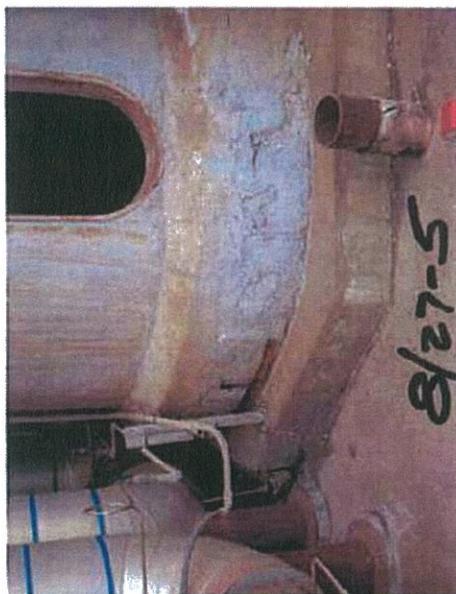
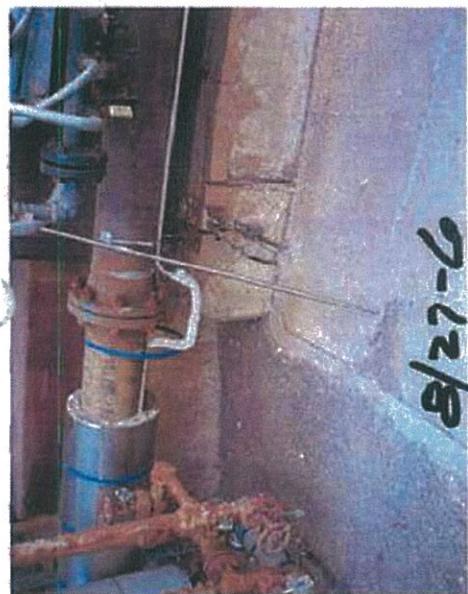
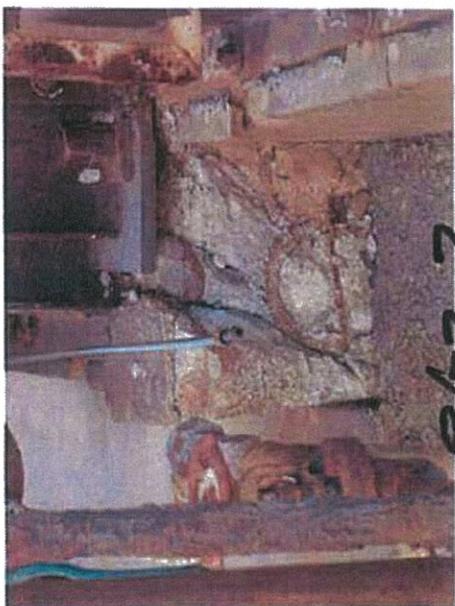
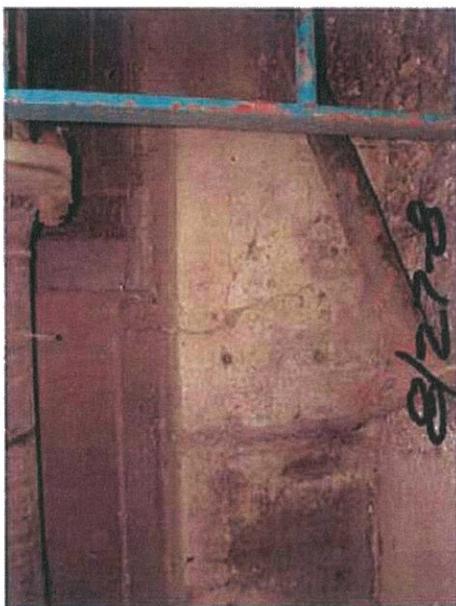
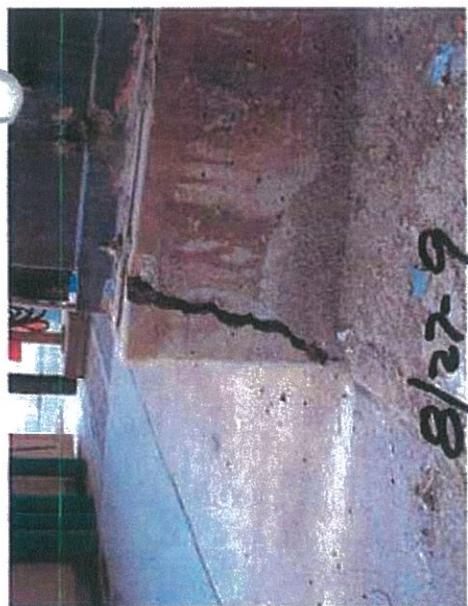
Notes by Engineer:

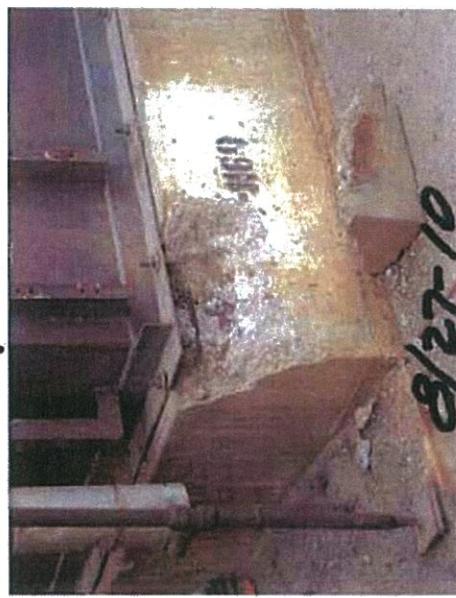
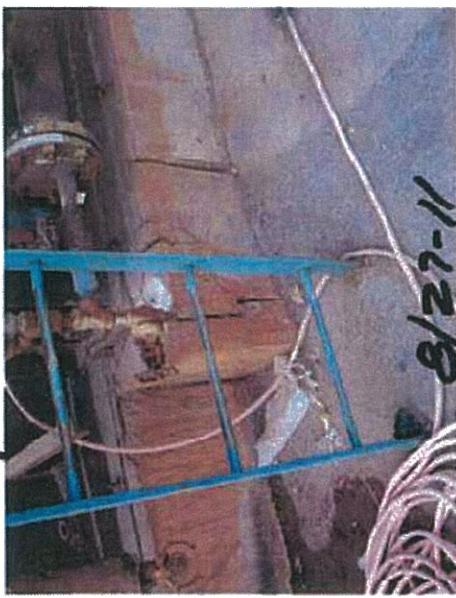
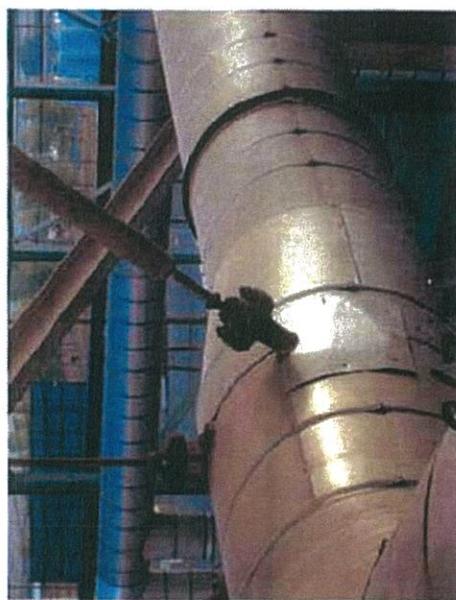
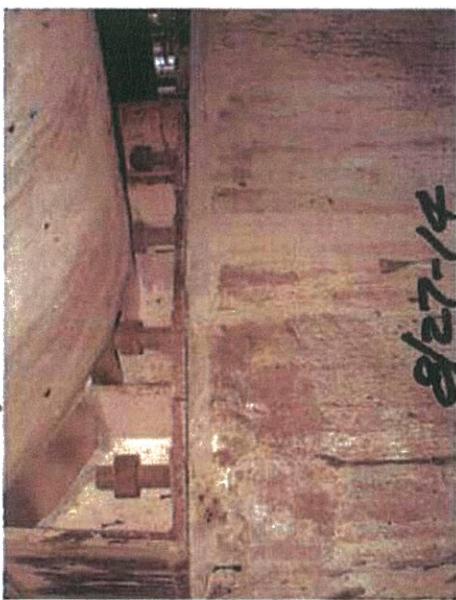
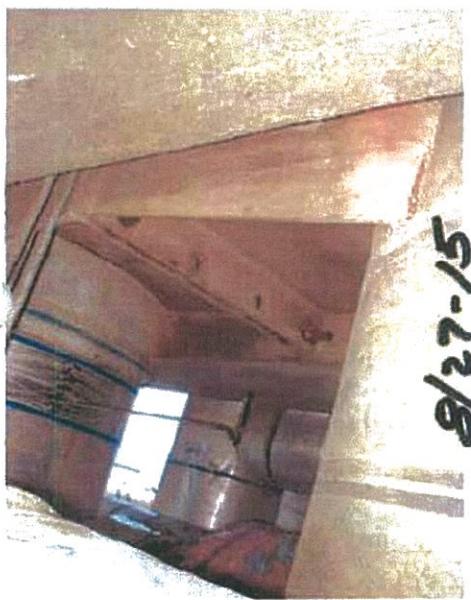
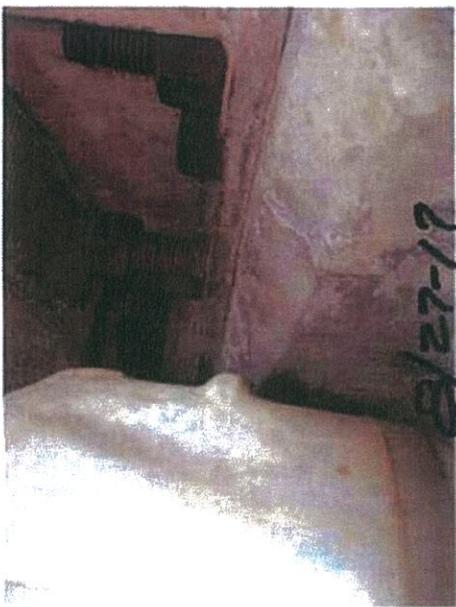
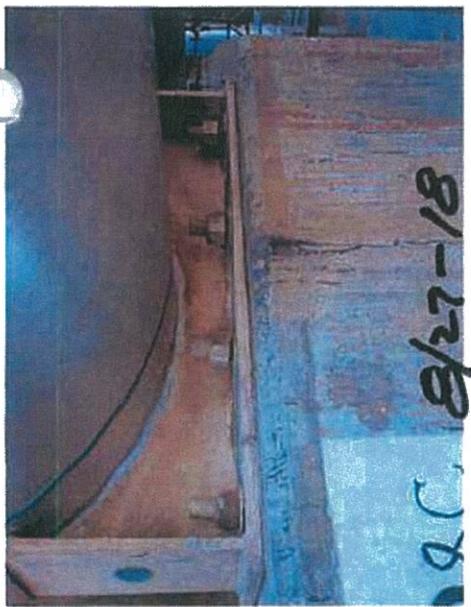
14/14

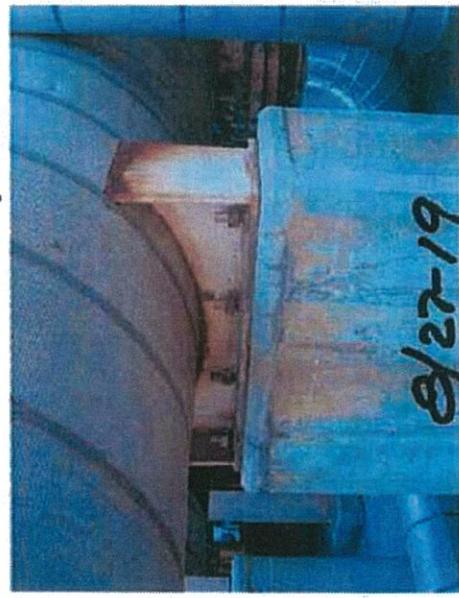
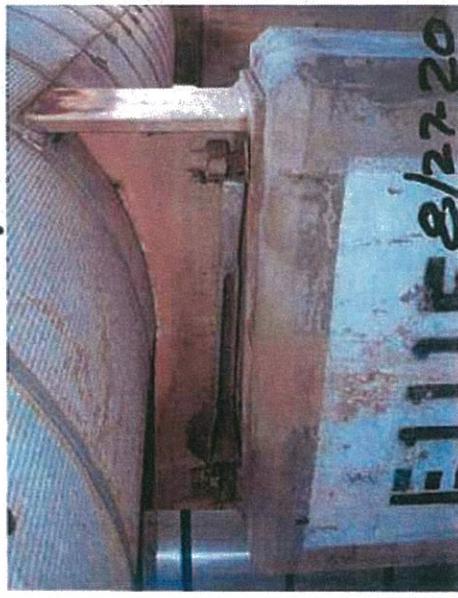
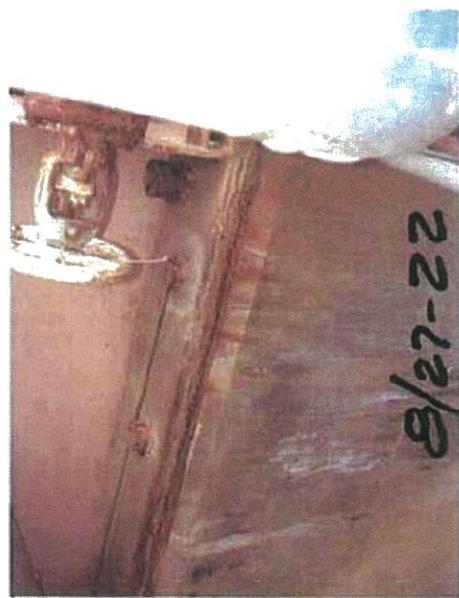




CUSA-CSB-0000757  
EPA







A Chevron Company

ABU: D&R

Plant: #4 CRUDE UNIT

Review Date: 9/1/2009

## Chevron Richmond Refinery

### Latent Conditions Checklist

Latent conditions are human factor issues that have not been resolved. These types of conditions may exist in areas of the Refinery and may lie unrecognized until combining with active failures (an appropriate or inappropriate action) to result in an incident.

The purpose of this checklist is to identify human factors issues to prevent and reduce the possibility of accidental releases of regulated substances that have the potential to cause significant harm to the public health or result in a major chemical accident or release.

#### Communication

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
4- 2	Is communications equipment adequate for the number of persons or stations who must communicate with each other?	Radios are assigned to individual operator positions, however, there are not enough radios to cover all persons. Management is aware of this issue.	Yes	No	
4- 1	Are the communications facilities between process units adequate for clear and uninterrupted communications during both normal and emergency situations [e.g., telephone land lines, radio, computer network, and E-mail, and are systems redundant and/or secure]	During emergency situations the radio system can be overloaded and operation becomes intermittent. Phones, e-mail and the computer system are normally OK. Line of sight contact can be made between two handheld devices.	Yes	No	
4- 4	Are communications adequate to inform workers of any hazards?	Yes. Yellow signs, MSDSSs, turnovers, refinery and community notification, Community Warning System, ID speaker system, orange phone, red phone. JHAS required for Maintenance work. HSEs are performed on MOCs and other non-routine tasks.	Yes	No	
4- 5	Are there good communication methods from management to hourly personnel?	Routine communication good. Electronic "Daily Order Book" e-mail, phone, radio, RSC and STL on site 24 hours a day.	Yes	No	

A Chevron Company

ABU: D&R

Plant: #4 CRUDE UNIT

Review Date: 9/1/2009

## Chevron Diamond Refinery

### Latent Conditions Checklist

Latent conditions are human factor issues that have not been resolved. These types of conditions may exist in areas of the Refinery and may lie unrecognized until combining with active failures (an appropriate or inappropriate action) to result in an incident.

The purpose of this checklist is to identify human factors issues to prevent and reduce the possibility of accidental releases of regulated substances that have the potential to cause significant harm to the public health or result in a major chemical accident or release.

#### Communication

Item #	Question	Observations	Addressed	May MCAR?	Recommendation	
5— 6	Are communications systems susceptible to electromagnetic interference during any operating mode of the plant?	No known electromagnetic interference issues.	Yes	No		
5— 7	Is there an environment of trust between hourly workers and supervisors, such that, feedback communications are used?	Yes. Dialog between operators and management and supervisors takes place routinely.	Yes	No		
5— 8	Are communications required at periodic intervals so that injured or incapacitated operators can be identified?	There is no set time period for routine check in.	Yes	No		
4— 3	Is the communication capability between operators, and between operators and the control room or other necessary locations adequate during normal operations and emergencies?	During emergency situations the radio system can be overloaded and operation becomes intermittent. Phones, e-mail and the computer system are normally OK. Line of sight contact can be made between two handheld devices	Yes	No		
Hardware	Item #	Question	Observations	Addressed	May MCAR?	Recommendation
4—54	Are all tools and equipment necessary to perform routine and necessary tasks available?	Nomex coveralls, gloves, safety glasses, hard hats, safety shoes, wrenches and other tools are provided and appropriate for the job.	Yes	No		

A Chevron Company

ABU: D&R

Plant: #4 CRUDE UNIT

Review Date: 9/1/2009

## Chevron Diamond Refinery

### Latent Conditions Checklist

Latent conditions are human factor issues that have not been resolved. These types of conditions may exist in areas of the Refinery and may lie unrecognized until combining with active failures (an appropriate or inappropriate action) to result in an incident.

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#### Hardware

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
4-56	Are all tools required for special tasks and emergency operations available?	All tools necessary are available	Yes	No	

4-55 Are the tools and equipment provided suited for the tasks being conducted?

Nomex gloves, safety glasses, hard hats, safety shoes, wrenches and other tools are provided and appropriate for the job.

4-57 If an instrument is unreliable, is there other information which is conveniently located and which can be used for cross-checking?

The instruments are generally reliable, there is backup when necessary. Atmospheric and Vacuum Furnaces have redundant flow meter and backup temperature indication.

#### Control Room & Panel Design

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
3-37	Can the operators or other personnel override automatically activated safeguards?	Shutdowns can be bypassed in the field and some can be bypassed from control room.	Yes	No	

3-29 Are alarms or signals clear and distinguishable?

Yes there are different sounds for the different categories of alarms. Some operators would like to have a dedicated alarm status summary page showing each alarm that is out of range.

A Chevron Company

ABU: D&R

Plant: #4 CRUDE UNIT

Review Date: 9/1/2009

## Chevron Diamond Refinery

### Latent Conditions Checklist

Latent conditions are human factor issues that have not been resolved. These types of conditions may exist in areas of the Refinery and may lie unrecognized until combining with active failures (an appropriate or inappropriate action) to result in an incident.

The purpose of this checklist is to identify human factors issues to prevent and reduce the possibility of accidental releases of regulated substances that have the potential to cause significant harm to the public health or result in a major chemical accident or release.

#### Control Room & Panel Design

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
3-28	Do the process control system displays for similar equipment (e.g., parallel trains or similar equipment in series) present the information in a unique manner to avoid confusion?	Each one of the crude unit furnaces is easily distinguished	Yes	No	
3-27	Do the process control system displays adequately present the process information [consider the logical layout of process or equipment configuration, information, consistent presentation of information, visibility of information from various work position	This is not a problem in #4 Crude Unit	Yes	No	
3-26	If required, does the process control system console layout allow for response by multiple personnel?	Yes, there is room for adequate personnel working simultaneously during an emergency.	Yes	No	
3-25	Does the process control system console layout allow for rapid response to upset situations?	Control pages are crowded and hard to find, making move slowly. This may be of particular concern during emergency operations.	Yes	No	
		This has been addressed in the #4 Crude Unit 2009 ISS Assessment (finding for item 4A2).			

A Chevron company

ABU: D&R

Plant: #4 CRUDE UNIT

Review Date: 9/1/2009

# Chevron Diamond Refinery

## Latent Conditions Checklist

Latent conditions are human factor issues that have not been resolved. These types of conditions may exist in areas of the Refinery and may lie unrecognized until combining with active failures (an appropriate or inappropriate action) to result in an incident.

The purpose of this checklist is to identify human factors issues to prevent and reduce the possibility of accidental releases of regulated substances that have the potential to cause significant harm to the public health or result in a major chemical accident or release.

### Control Room & Panel Design

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
3-37.	Do(es) the control system(s) have 1 test switch positions which allow bypass of safety features while performing test and calibration tasks?	Yes	Yes	No	
3-32	When a control action has been made, is there a display to indicate that the required plant change has been made (i.e., it is misleading only to indicate that the control signal has been sent)?	Process condition signal changes indicate that the valve in the field has moved.	Yes	Yes	
3-49	Are calculations performed by operations personnel documented in a consistent manner and periodically checked for correctness?	No operator calculations required	Yes	No	
3-24	If displays are shared with another unit, does it cause any problems at times?	Displays are not shared.	Yes	No	
3-34	Are emergency shutdown switches guarded against inadvertent operation [consider location, switch operation, and guards or covers]?	Refer to item 3-2.	Yes	No	
3-39	Are control system display targets (touch screens) spaced adequately to prevent accidental operation?	There are no touch screens in #4Crude Unit.	Yes	No	

A Chevron company

ABU: D&R

Plant: #4 CRUDE UNIT

## Chevron Diamond Refinery

### Latent Conditions Checklist

Review Date: 9/1/2009

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#### Control Room & Panel Design

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
3-50	Does the level of automation allow sufficient operator involvement so operators do not feel detached from the process, particularly during emergency situations where they must assume manual control?	Yes, the level of automation allows sufficient operator involvement.	Yes	No	
3-23	Are displays of process control instrumentation clearly identified?	Yes the displays of process control instrumentation are clearly identified.	Yes	No	
3-45	Are alarms arranged, or otherwise coded, according to their level of urgency (i.e., is there an alarm priority system)?	Critical and secondary alarms have different tones.	Yes	No	
4-53	Is it easy to communicate with related groups of workers (i.e., upstream and downstream processes, below or above in hierarchy of decision making)?	RSC, STL, and RMC are examples of decision making process between different areas. They are here 24/7.	Yes	No	
3-37	Is the test switch position, 3 administratively controlled?	There is no restricted access to the alarm test switches.	Yes	No	
3-44	Are critical alarms prioritized to alert operations personnel to upset situations that require immediate response?	Critical alarms are prioritized over the secondary alarms.	Yes	No	

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#### Control Room & Panel Design

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
3-38	Are the alarm indicators routinely tested?	There are daily, monthly and quarterly tests based on the criticality of the alarm.	Yes	No	
3-40	Are the control system display symbols consistent and meaningful?	Control system displays are consistent and meaningful.	Yes	No	
3-31	Does the feedback provide operators with logical information (e.g., is 100% valve output equivalent to valve wide open)?	Control output indication is consistent.	Yes	No	
3-43	Can color blind, left-handed, etc. operators operate in the control room sufficiently?	No known problems. Different sounds distinguish different alarms.	Yes	No	
3-41	Are the control system display symbols standardized (i.e., consistent representation and common use of acronyms, abbreviations, and equipment tags)?	Control system displays use standardized symbols.	Yes	No	
3-6	Is the cause of "nuisance" alarms (repetitive alarms that operations personnel ignore or acknowledge without investigating) determined and repaired in a timely manner?	Maintenance is prioritized based on criticality. Repairs are made in a timely manner.	Yes	No	

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#### Control Room & Panel Design

Item #	Question	Observations	Addressed	May NCAR?	Recommendation
3-33	Is it easy to work at or move past the control panel without accidentally altering any of the controls?	Yes	Yes	No	
3-30	Do the process control system displays provide feedback to operations personnel to confirm operator actions?	The operator can see the change to the measured variable that will indicate the operator action has been effected.	Yes	No	
3-48	Will the keys for locked control functions be readily available during an emergency? (The items in question are the control functions that are generally locked during normal operation but may be required during a plant upset)	There are no locked control functions.	Yes	No	
3-51	Are instruments, displays, and controls promptly repaired after malfunction?	Maintenance is prioritized based on criticality. Repairs are made in a timely manner.	Yes	No	
3-35	Are board-mounted shutdown switches or buttons sufficiently distinguishable/separated from alarm acknowledgment buttons to minimize inadvertent operation?	Yes. No problems in the crude unit.	Yes	No	

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#### Control Room & Panel Design

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
3-36	Are emergency isolation valves operable from the control room?	Yes, emergency isolation valves can be operated from the control room.	Yes	No	
3-47	Are equipment "run" indicators (running lights or other process indicators) and valve position indicators provided at a continuously staffed location for critical equipment, valves, and instruments?	All critical equipment is continuously monitored and controlled from the control room. Info is available on Honeywell console, manned 24 hours a day.	Yes	No	
3-37	Is there an indication available to 2 operators which shows that the control system is in a test mode and that the safety features are bypassed?	Yes. Furnace safety shutdowns are an example.	Yes	No	
4-52	Is sufficient lighting provided in the control room during a loss of power to allow operators to perform emergency actions?	Adequate emergency lighting is provided in the control room.	Yes	No	
Work Environment					
4-69	Are the control building air conditioning and pressurization adequate to prevent intrusion of toxics, flammables, or corrosive contaminants (if applicable)?	Yes, the control room is pressurized and the inlet air is filtered. Monthly inspection/maintenance by Estes.	Yes	No	

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#### Work Environment

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
4-73	Are employees protected from excessive noise? NOTE: "Excessive" to the point that it affects mental workload and cognitive ability as opposed to physical harm (e.g., "it is so loud I cannot concentrate")	Red lines indicate high noise areas. Ear plugs are worn routinely. Equipment noise levels are monitored annually.	Yes	No	
4-71	Can the HVAC system in the control room be isolated quickly from outside air?		Yes	No	
4-70	Are environmental conditions, such as humidity, satisfactory?		Yes	No	
4-66	Is the control room lighting adequate [review direct and indirect lighting]?	Control room lighting is adequate.	Yes	No	
4-68	Are the control building air conditioning and pressurization adequate to protect the electronic instrumentation?		Yes	No	
4-67	Is the control room emergency lighting (light fixtures on the emergency power circuit) adequate?	The control room emergency lighting is adequate.	Yes	No	

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#### Work Environment

Item #	Question	Observations	Addressed	Map MCAR?	Recommendation
4-72	Are employees protected from excessive heat and cold? 1 NOTE: "Excessive" to the point that it affects mental workload and cognitive ability as opposed to physical harm (e.g., "I am so hot I cannot concentrate")	No known problems. Procedures in place for high heat jobs.	Yes	No	

4-65 Is the emergency lighting (light fixtures on the emergency power circuit) adequate in the unit?

Outside emergency lighting in the units is good in most areas.

4-65 Is the emergency lighting (light fixtures on the emergency power circuit) adequate in the unit?

Outside emergency lighting in the units is good in most areas.

#### Process Design and Labeling

Item #	Question	Observations	Addressed	Map MCAR?	Recommendation
3-13	Are all equipment labels (e.g., vessels, piping, valves, instrumentation, etc.) easy to read (clear and in good condition)?	Not all equipment labels are perfectly clear (oily, dirty, broken, absent). In particular, lines at the plot limit are inadequately identified.	No	No	Consider review of labels in #4 Crude Unit, especially lines at the plot limit. Review should include compliance with RI-302 (Color Identification and Labeling of Equipment and Pipelines).

3-3 Are shutdown switches and other controls required for emergency operation readily accessible to the operator from a safe location?

Yes, remote shutdown switched are in a safe location.

Yes

No

4-9 Are control valves and associated instrumentation accessible for maintenance?

Yes. No known problems.

Yes

No

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#### Process Design and Labeling

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
4 – 7	Are field instrument indicators routinely checked for accuracy?	No, repairs are made as needed.	Yes	No	
4 – 6	Are the engineering units of similar instruments consistent [e.g., do the pump seal flush rotameters all display flow in either gpm or gph]?	Yes, engineering units of similar instruments are consistent.	Yes	No	
3 – 19	Do switch labels identify discrete positions (e.g., ON or OFF, OPEN or CLOSE)?	Switch label positions are discrete, though not all switch labels are clear or readable. Items will be corrected on an individual basis.	Yes	No	
3 – 22	Are pipelines clearly labeled at points where they become invisible (e.g., routed underground)?	Only cooling water and fire water go underground in #4 Crude. These are labeled or identifiable. Lines in pipe racks are difficult to identify. This has been addressed in Latent Conditions item 3-13.	Yes	No	
3 – 4	If applicable, are process drain valves located to allow personnel to monitor levels while draining?	If drain is out of sight of indicators, operators can communicate with radios to monitor levels while draining.	Yes	No	
3 – 5	Are adequate process vents and drains available?	Yes, adequate process vents and drains are available.	Yes	No	

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#### Process Design and Labeling

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
3- 1	Are remote startup/shutdown switches clearly labeled and protected from inadvertent operation?	Remote startup/shutdown switches are clearly labeled.	Yes	No	
4- 8	Are field instrument ranges appropriate for the service [e.g., avoid using a 0-2500 psig pressure gage on a 100 psig system]?	Yes. No known problems.	Yes	No	
3- 21	Are caution and warning signs easy to read [consider letter size and color]?	Yes, signage is clear and easily readable.	Yes	No	
3- 14	Are all equipment labels correct and unambiguous?	Generally, equipment labeling is good.	Yes	No	There is a specific instance of ambiguous labeling of the #4 Crude Unit hairpin exchangers (on off gas compressors). This issue has already been identified and an LPO generated (1516303).
3- 15	Are all equipment labels located close to the items that they identify?	Yes, usually on the piece of equipment.	Yes	No	
3- 16	Do all equipment labels use standard terminology (e.g., acronyms, abbreviations, equipment tags, etc.)?	Yes, the labeling follows standard terminology.	Yes	No	

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#### Process Design and Labeling

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
3-17	Are the equipment labels consistent with nomenclature used in procedures?	Yes, equipment labels are consistent	Yes	No	
3-12	Are there enough indications and controls available to adequately place the plant in a safe and stable state, or safely shutdown the plant, in the case of an emergency?	There are 11 hand switches on the control panel that will safely shut down the unit.	Yes	No	
3-18	Are all components that are mentioned in procedures (e.g., valves) labeled or otherwise identified?	Yess, components that mentioned in procedures are labeled or otherwise identified.  Note that on control valve manifolds, block valves and bypass valves are not individually labelled, however their associated control valves are clearly identified.	Yes	No	
3-11	Are operating ranges for process variables specified in the same engineering units as the instrument read-out or indicator (i.e., mental conversion of units is avoided)?	Some field indicators read in percent of total (ie, flow) instead of actual range of flow.	Yes	No	
3-10	Is equipment (e.g., emergency control valves, ladders) accessible in an emergency?	All emergency controls in the field are at ground level. Operators do not permit staging, etc to be placed in any way that would limit access. Other equipment is accessible when needed.	Yes	No	

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### Process Design and Labeling

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
3- 2	Are remote switches for different systems separated by sufficient distance to prevent operation of the wrong system during stressful situations?	The wrong furnace has been choiced in the past as two switches are close together. It is possible that a cover over the switch might prevent this.	No	No	Consider providing covers over CM/C/shutdown switches on #4 Crude Unit control board to prevent operation of incorrect switch during emergency situations.

3- 20 Are signs (e.g., emergency exit, restricted entry, etc.) clearly visible [consider location and condition]?

Yes, yellow lined areas, red lined areas are marked emergency evac routes are indicated.

No

3- 21 Are escape routes clearly labeled, lighted, and maintained clear of obstacles?

Escape routes are marked and lighting is adequate. Operators are focused on keeping escape routes clear of obstacles.

Yes

No

4- 63 Does the protective gear allow freedom of movement necessary to perform necessary tasks (routine and emergency)?

Yes, Scott air packs, turnout gear and normal safety gear are suitable and convenient for use.

Yes

No

4- 64 Are escape routes clearly labeled, lighted, and maintained clear of obstacles?

Escape routes are marked and lighting is adequate. Operators are focused on keeping escape routes clear of obstacles.

Yes

No

4- 65 Does the protective gear allow freedom of movement necessary to perform necessary tasks (routine and emergency)?

Yes, Scott air packs, turnout gear and normal safety gear are suitable and convenient for use.

Yes

No

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#### Safeguards

Item #	Question	Observations	Addressed	Map MCAR?	Recommendation
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4-59 Does the location of first aid supplies allow for rapid access and use?

Emergency PPE is conveniently located. EMTs are available on call 24/7 for first aid. However, there is a concern that there is an insufficient number of SCBA to protect control room personnel in use?

No Yes No  
Consider evaluating number of SCBA units in control room to protect all control room personnel in D&R control room.

#### Management System

Item #	Question	Observations	Addressed	Map MCAR?	Recommendation
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5-56 Has the facility established clear lines of accountability for the administration and enforcement of contract requirements?

Instructions are normally clear. If an employee has any questions they are discussed and resolved before starting work. Safety is a priority for all.

No Yes  
No

5-54 Is there a team responsibility for operating a unit?

Yes No  
No

5-81 Do supervisors provide the required training to the worker?

No Yes  
No

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Management System	Item #	Question	Observations	Addressed	Map MCAR?	Recommendation
	5-57	Is there a clear line of authority and responsibility from the workers up through management?	There is a clear line of authority and responsibility from the workers up through management.	Yes No		
	5-53	Are operators' individual responsibilities clearly defined?	Yes, operator roles and duties are clearly defined.	Yes No		
	5-73	Is lower management aware of problems regarding procedure implementation and compliance?	This is not a problem.	Yes No		
	5-82	Do supervisors discuss job hazards with workers prior to starting work?	Yes, the JHA and HSE processes are routinely used for this purpose.	Yes No		
	5-72	Does lower management implement required programs for worker safety?	Yes. Examples: Mandatory training, LOTO, audits, IIF, LPS.	Yes No		
	5-80	Are required procedures provided or communicated to the worker by supervision?	The EOM is available on the refinery web.	Yes No		
	5-85	Do supervisors provide the worker with the proper tools and equipment to perform the work safely?	No deficiencies noted.	Yes No		

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#### Management System

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
5-77	Does lower management define stop-work authority for first line supervisors and their staff?	Anyone (supervisor, staff, worker, company, contractor) can stop a job if it is unsafe.	Yes	No	
5-78	Does management take timely corrective actions when problems occur or are identified?		Yes	No	
5-84	Do supervisors confirm the readiness to perform work prior to the execution of work?	LOTO and JHA are signed off by HO and HM.	Yes	No	
5-74	Is lower management involved in the work planning, control, and execution process?	Yes, Operations Supervisor is involved in the work planning and execution by way of the JHA, LOTO and the Maximo work management system.	Yes	No	
5-71	Does lower management ensure that required procedures are developed and kept current to assure a safe work environment?	This is generally true. Work in progress to keep current procedures up to date.	Yes	No	
4-27	Are staff levels (both size and experience) sufficient to handle routine and nonroutine duties that can be reasonably expected to occur during a shift?	Each operator is fully qualified to perform his/her job. There are enough to cover all the jobs on a crew. All jobs must be covered even if a force-out is required.	Yes	No	

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#### Staffing & Overtime

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
4-31	Are sufficient tasks assigned during low activity operation to minimize the effects of boredom (e.g., possible loss of alertness)?	There are always routine duties, training requirements, housekeeping duties to keep active and alert.	Yes	No	
4-30	Can tasks requiring the operator to perform nearly simultaneous actions be accomplished without traveling large distances (e.g., switching unit rundown into an alternate rundown line, lighting furnace burners, etc.)?	No routines tasks meet this description. Backup is available for unusual situations.	Yes	No	
4-29	Is there backup assistance when an operator emergency responder must respond to an emergency?	The on-crew operator will not be released to respond to an emergency outside his/her area unless backup is available.	Yes	No	
Climate & Culture					
Item #	Question	Observations	Addressed	May MCAR?	Recommendation
4-43	Do workers understand they have the authority to shutdown unsafe operations or maintenance activities?	Yes, they believe employee can, and should, shutdown unsafe activities; including contract employees.	Yes	No	
4-39	Can operators resolve conflicts between productivity and safety?	Yes, Tenets of Operation. Safety is always the priority.	Yes	No	

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#### Climate & Culture

Item #	Question	Observations	Addressed	May MCAR?	Recommendation	
4-44	Do workers feel that unsafe operations or maintenance activities can be shutdown without fear of retaliation?	Yes	Yes	No		
4-40	Is there an attitude of non-penalization when an operator says there is a failure and there is not?	Operators feel comfortable about warning people about possible safety concerns.	Yes	No		
4-46	Is job planning by supervisors adequate?	No issues.	Yes	No		
4-48	Have there been site goals and objectives established for the Safety Program elements at all levels of the organization?	The goal is clearly to go home in the same condition as when you arrived. IIF policy, LPS.	Yes	No		
4-45	Is the immediate supervision and instructions provided by first line supervisors adequate?	Yes, face-to-face communication , e-mail, phone discussions and followup as needed take place routinely.	Yes	No		
4-38	Are employees disciplined for taking risks to increase/maintain production without regard for safety?	No. Each employee must use judgement on level of risk. Employee decision is generally supported by management.	Yes	No		
Training	Item #	Question	Observations	Addressed	May MCAR?	Recommendation

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### Training

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
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- 4-12 Are the effects of changes to process control operations clearly defined to the process control operator?

- 4-11 Are process control operators and field operators cross-trained?

### Procedures

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
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- 2-33 If separate procedural training documents are used, are they consistent with the actual procedures?

- 2-28 Are calculations clear and easy to understand?

- 2-43 Do operating crews communicate unusual equipment, control, or instrument status (bypassed or out of service) in writing?

- 2-32 Are the actual procedures used in the operator training programs?

No

Yes

No

No

No

No

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### Procedures

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
2-38	Do procedures prevent changing process control system or safety shutdown system control or logic (software) without proper review and authorization?	Yes, the MOC process requires review, authorization and training	Yes	No	
2-37	Are alarm changes (set point or priority) communicated to all affected employees?	Yes, the MOC process must be used to change alarm set points and all operators receive communication via the MOC process.	Yes	No	
2-36	Do procedures prevent changing alarm set points without proper review and authorization?	Yes, MOC process requires review and authorization for alarm setpoint changes.	Yes	No	
2-35	Is equipment and instrumentation clearly labeled and are the equipment and instrument tag numbers used in the procedures?	In general, the labeling in the plant is good. The numbering is consistent between the plant and the manuals.	Yes	No	
2-20	Is all information necessary for performing procedures included or referenced in the procedure?	Yes, the EOM contains all needed documents.	Yes	No	
2-11	Are procedures difficult to use?	Consistency in the quality of procedures is a concern. This is especially an issue with startup and shutdown procedures. The need for improvement is recognized, and efforts to correct this are ongoing.	No	No	Consider evaluation of current #4 Crude Unit procedures for accuracy and consistency, particularly startup and shutdown.

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### Procedures

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
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- 2-50 Do operators have time to respond in an emergency and report, in accordance with the procedures, appropriately?

- 2-49 Do procedures require that individuals perform multiple tasks simultaneously that practically cannot be performed?
- 2-39 Are process control system or safety shutdown system changes communicated to all affected employees?

### Conflicts between practice and procedures

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
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- 3-61 Are procedures consistent with actual operating practices, particularly operating practices responding to emergency or upset conditions?

A process exists to allow experienced operators to review and update procedures.

### Individual Experience, Knowledge

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
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#### Individual Experience, Knowledge

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
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- 1 – 3 Are workers knowledgeable of the type and magnitude of the hazards associated with their work?
- 1 – 4 Are the worker's knowledge, skills, and abilities adequate to perform the job safely?

Yes. Operators receive a significant amount of training, via Computer Based Training (CBT), one-on-one training with senior personnel

- 1 – 5 Do operators have sufficient knowledge to safely operate or shutdown the unit in emergency situations where they must assume manual control?
- Concern is that it is primarily senior operators shutdown the unit. Thus, other operators do not have the opportunity to acquire shutdown experience, and control simulation is inadequate for training.
- Senior operators have sufficient knowledge to safely operate or shutdown the unit in emergency situations where they must assume manual control.
- Consider improving Crude Unit simulator for shutdown/emergency training, and ensure that operators are given ample simulator training time.

#### Stress, Fatigue, Substance Abuse

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
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- 2 – 8 Are there jobs that are beyond employees' physical limits or safe physical limits (e.g., carrying equipment, that requires both hands, up stairs that are poorly lighted at night?)
- No known problem areas, each employee is encouraged to ask for assistance if needed.



# Chevron Diamond Refinery

## Latent Conditions Checklist

Review Date: 9/1/2009

**Plant:** #4 CRUDE UNIT  
**ABU:** D&R

Latent conditions are human factor issues that have not been resolved. These types of conditions may exist in areas of the Refinery and may lie unrecognized until combining with active failures (an appropriate or inappropriate action) to result in an incident.

The purpose of this checklist is to identify human factors issues to prevent and reduce the possibility of accidental releases of regulated substances that have the potential to cause significant harm to the public health or result in a major chemical accident or release.

### Stress, Fatigue, Substance Abuse

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
1— 6	Are emergency procedures presented in a clear, step-by-step format to reduce the "Panic" factor during upset situations?	Yes, the EOM has immediate action steps, followed by stabilizing steps for emergency shutdown.	Yes	No	
2— 9	Are periods of sustained concentration shorter than one hour (including emergencies) (i.e., is there adequate staffing and backup to accommodate mental and physical breaks?)	This can be an issue during upsets, but is generally not a problem.	Yes	No	

### Shiftwork

Item #	Question	Observations	Addressed	May MCAR?	Recommendation
1— 18	Are job turnover communications oral, allowing discussions and questions?	Yes, oral communication is required in addition to electronic turnovers.	Yes	No	
1— 14	Are shift turnover communications maintained in an accessible log?	Yes, in the computer electronic Filemaker turnover	Yes	No	
1— 13	Are shift turnover communications sufficient to adequately communicate plant operating conditions from off shift to on-shift personnel?	Turnovers are both electronic and verbal. There is sufficient communication, however verbal communications may be impacted by scheduling issues.	Yes	No	
1— 16	Are job turnover communications between shift adequate?	Turnovers are both electronic and verbal.	Yes	No	

Wednesday, December 02, 2009

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A Chevron Company  
ABU: D&R

## Chevron Diamond Refinery

### Latent Conditions Checklist

Review Date: 9/1/2009

Plant: #4 CRUDE UNIT

Latent conditions are human factor issues that have not been resolved. These types of conditions may exist in areas of the Refinery and may lie unrecognized until combining with active failures (an appropriate or inappropriate action) to result in an incident.

The purpose of this checklist is to identify human factors issues to prevent and reduce the possibility of accidental releases of regulated substances that have the potential to cause significant harm to the public health or result in a major chemical accident or release.

#### Shiftwork

Item #	Question	Observations	Addressed	Map MCAR?	Recommendation
1–17	Are job turnover communications between shift operations and supervisors and managers adequate?	Yes, STL and RSC each have a turnover, followed by a conference call with HO.	Yes	No	
1–15	Are job turnover communications within shifts adequate?	Turnovers within a shift is not a normal occurrence, but when a special situation arises, the needed communication is done well.	Yes	No	

#### Participants:

ABUM: <input checked="" type="checkbox"/> <u>John</u>	Technical Rep(s): <input type="checkbox"/> Jacques Cartier	Maintenance Rep(s): <input type="checkbox"/>
OA: <input type="checkbox"/> <u>Ben Huise</u>	Operator(s): <input checked="" type="checkbox"/> Ben Huise (Facilitator), Ben Purvis (Process Eng)	
AS: <input type="checkbox"/> <u>Mark Crow</u>	Other Participants: <input type="checkbox"/> Mark Crow (Designer Eng), Ben Purvis (Process Eng)	<input type="checkbox"/> Certified as <u>Mark Crow</u>

Certified by sign-off that the checklist was applied properly:

Applicability:  
Y = The concern raised by the question has already been addressed. No further documentation is required.  
N = Concern raised by the question has not been addressed. Further documentation and analysis is required  
N/A = Concern raised by the question is not applicable for the area under review

# INHERENTLY SAFER SYSTEMS REVIEW

Location: Chevron Richmond Refinery

ABU: D&R

PFD Title:

Unit: #4 CRUDE UNIT

PFD Number:

PFD:

Node Description:

-

Hazards:

PFD Revision Date:

Design Conditions:

Review Team: Facilitator - Mark Crow

OPS - Jacques Carter

Process Engineer - Ben Purvis

Design Engineer - Ben Hulse

Question ID:	Question	Discussion/Existing Safeguards	Recommendation
1A1	Reduce hazardous raw materials inventory?	#4 Crude Unit chemical inventory is kept to a minimum. Includes aqueous ammonia, anti-foam, demulsifier.	
1A2	Reduce intermediate storage and inventory?	There are no intermediate products stored in #4 Crude Unit.	
1A3	Reduce finished product inventory?	Finished product inventory is sent to other units from #4 Crude Unit.	
1B1	Reduce hazardous material inventory by using alternate equipment?	Equipment used is standard for crude processing.	
1B2	Minimize length of hazardous material piping runs?	Piping runs in #4 Crude Unit are minimized as designed.	
1B3	Use smallest diameter piping?	Piping sizes are the smallest possible for the capacity of the unit	
1B4	Reduce pipeline inventories by changing hazardous materials from liquid to gas?	N/A	
1B5	Reduce production of hazardous waste or by-products?	Dessalter effluent and sour water are minimized per standard operation.	

# INHERENTLY SAFER SYSTEMS REVIEW

Location:	Chevron Richmond Refinery	ABU:	D&R	Unit:	#4 CRUDE UNIT
PFD Number:		PFD Title:		PFD Revision Date:	
Node Description:	-	Hazards:			
Design Conditions:		Process Engineer - Ben Purvis			
Review Team:	Facilitator - Mark Crow OPS - Jacques Carter	Design Engineer - Ben Hulse			
Question ID:	Question	Discussion/Existing Safeguards	Recommendation		
2A1	Use an alternative process or chemistry to completely eliminate hazardous raw materials, intermediates or by-products?	No alternative processes are available to eliminate any hazards presented by the raw materials.			
2B1	Use an alternative chemistry or process conditions to completely eliminate in-process solvents and flammable heat transfer media?	Industrial standard processes used.			
2C1	Substitute less hazardous raw materials?	Raw materials in use are of minimal hazard.			
2D1	Substitute less hazardous final product solvents?	N/A			
3A1	Limit supply pressure to less than MAWP of vessels?	Existing vessels are protected by PSVs when needed			
3B1	Use a different catalyst?	Catalyst is not used in #4 Crude Unit			
3C1	Improve thermodynamics or kinetics to reduce operating pressures and temperatures?	Current operating conditions are currently at the lowest possible temperature and pressure			
3C2	Change reaction phase to reduce operating pressures and temperatures – liquid/liquid, liquid/gas, gas/gas?	Not a possible alternative in this application			

# INHERENTLY SAFER SYSTEMS REVIEW

Location:	Chevron Richmond Refinery	ABU:	D&R	Unit:	#4 CRUDE UNIT
PFD Number:		PFD Title:		PFD Revision Date:	
Node Description:	-	Hazards:			
Design Conditions:		Hazards:			
Review Team:	Facilitator - Mark Crow OPS - Jacques Cartier	Process Engineer - Ben Purvis Design Engineer - Ben Hulse			
Question ID:	Question	Discussion/Existing Safeguards	Recommendation		
3C3	Change order of raw material addition to reduce operating pressures and temperatures?	Raw material addition sequence minimizes operating temperature.			
3D1	Dilute hazardous raw materials?	Raw materials currently diluted where applicable			
3E1	Avoid operating conditions where materials are subject to high temperature instability or freezing?	Current operation does not operate near any temperature range that would lead to unstable operation			
3F1	Change process conditions to avoid handling flammable liquids above their flash point?	Use industrial standards for crude operations			
3G1	Design equipment to contain process on temperature rise from loss of cooling?	Equipment uses PSVs to protect from overpressure, relieves to a contained system.			
3H1	Layout equipment to minimize congested and confined spaces to limit potential for blast overpressure in the event of a flammable release?	#4 Crude Unit equipment is spaced to provide sufficient circulation.			
3I1	Locate adjacent hazardous installations to minimize impact on unit?	Other units are spaced to allow for emergency access and minimize impact on, or from, adjacent units			
3J2	Minimize off-site impacts?	#4 Crude Unit is located at a distance from public areas			

# INHERENTLY SAFE SYSTEMS REVIEW

Location:	Chevron Richmond Refinery	ABU:	D&R	Unit:	#4 CRUDE UNIT
PFD Number:		PFD Title:		PFD Revision Date:	
Node Description:	-	Hazards:			
Design Conditions:					
Review Team:	Facilitator - Mark Crow OPS - Jacques Cartier	Process Engineer - Ben Purvis Design Engineer - Ben Hulse			
Question ID:	Question	Discussion/Existing Safeguards		Recommendation	
3I3	Minimize on-site impacts?	Other units are spaced to allow for emergency access and minimize impact on, or from, adjacent units			
3J1	Select pump with maximum capacity lower than safe rate of addition?	Pump capacity is appropriate for the feed rate of this operating unit			
3J2	Pipe size selected to prevent unsafe flow rates in gravity feed systems?	Piping is appropriately sized in the #4 Crude Unit			
3K1	Prevent hazardous material liquid spill from entering storm drainage system or sewer?	All drains in #4 Crude Unit are routed to API separators			
3L1	Prevent flammable material liquid spill from pooling under adjacent equipment causing a BLEVE in the event of fire?	In general, plant grade is sloped to area drains. No known problem areas			
3M1	Use passive safety design to prevent or reduce fire damage?	Passive safety design is used where applicable to prevent or reduce fire damage.			
3N1	Flammable material release from PSV routed to flare header?	All flammable materials that may be released from PSVs are routed to the flare system			
4A1	Easy operation of valves designed to prevent inadvertent error?	In general, valves are arranged in a logical manner			

# INHERENTLY SAFE SYSTEMS REVIEW

Location:	Chevron Richmond Refinery	ABU:	D&R	Unit:	#4 CRUDE UNIT
PFD Number:		PFD Title:		PFD Revision Date:	
Node Description:	-	Hazards:			
Design Conditions:					
Review Team:	Facilitator - Mark Crow OPS - Jacques Cartier	Process Engineer - Ben Purvis Design Engineer - Ben Hulse			
Question ID:	Question	Discussion/Existing Safeguards		Recommendation	
4A2	Simplified control displays?	Concern is that some control displays are cluttered, and finding a necessary screen may be time-consuming, especially during an upset.		Consider evaluating simplifying individual DCS screens, and organization of screens to improve control navigation within the #4 Crude Unit.	
4A3	Design temperature-limited heat transfer equipment?	Heat transfer media are appropriate for the applications		Examples include, but are not limited to: Process Overview, Flash Drum V-1102, Long Loop, Short Loop, Vacuum Column	
4A4	Use corrosion resistant materials?	Vessel specifications and piping classifications include a conservative wall thickness and an appropriate corrosion allowance for each service			
4A5	Operate at lower pressure?	Plant currently operates at the lowest possible pressure			
4A6	Operate at higher temperature to prevent cryogenic effects, like embrittlement failure?		There are no problems with cryogenic effects in #4 Crude Unit.		
4A7	Operate at lower temperature to prevent runaway reaction or material failure?		Currently operate at the lowest temperature possible		
4A8	Passive rather than active controls?	T-1108 Ammonia Tank, V-1106A Demulsifier Chemical Injection Drum, T-1104 Caustic Injection Tank have no spill containment.		Consider spill containment for T-1108 Ammonia Tank, V-1106A Demulsifier Chemical Injection Drum, T-1104 Caustic Injection Tank.	

# INHERENTLY SAFE SYSTEMS REVIEW

Location:	Chevron Richmond Refinery	ABU:	D&R	Unit:	#4 CRUDE UNIT	PFD Revision Date:
PFD Number:		PFD Title:				
Node Description:	-	Hazards:				
Design Conditions:		Review Team:	Facilitator - Mark Crow OPS - Jacques Cartier	Process Engineer - Ben Purvis Design Engineer - Ben Hulse		
Question ID:	Question	Discussion/Existing Safeguards	Recommendation			
4A9	Use buried or shielded tanks?	No buried or shielded tanks in #4 Crude Unit				
4A10	Use fail-safe controls on loss of utilities?	Control valves are designed to go to the safest position on loss of signal or instrument air				
4A11	Limit complexity and degree of instrument redundancy?	The instrumentation in the #4 Crude Unit is appropriate for the complexity/severity of the process. Alarm objectives analysis have been conducted on the #4 Crude Unit to eliminate the nuisance alarms				
4A12	Use refrigerated storage vs. pressurized storage?	No pressurized storage in #4 Crude Unit				
4A13	Electrical feed spread over independent or emergency sources?	#4 Crude Unit power is supplied from two different feeders				
4A14	Reduce wall area to minimize corrosion or fire exposure?	Vessel size, and therefore wall area, is minimized as designed				
4A15	Minimize connections, paths and number of flanges?	Connections, paths and number of flanges are minimized as currently designed				
4A16	Fewer bends in piping?	Bends and elbow/s in piping systems are minimized as designed.				

# INHERENTLY SAFER SYSTEMS REVIEW

**Location:** Chevron Richmond Refinery      **ABU:** D&R      **Unit:** #4 CRUDE UNIT  
**PFD Number:**  
**Node Description:** -  
**Design Conditions:**  
**Review Team:** Facilitator - Mark Crow      Process Engineer - Ben Purvis  
 OPS - Jacques Cartier      Design Engineer - Ben Hulse

Question ID:	Question	Discussion/Existing Safeguards	Recommendation
4A17	Expansion loops in piping in lieu of bellows?	No expansion bellows used in #4 Crude Unit.	
4A18	Isolation mechanisms for maintenance on equipment?	Double block and bleed or blinds are used to isolate equipment for maintenance for LOTO R19900	
4A19	Limit manual operations – like sampling, hose handling, filter cleaning?	Concern is that the current resid and desalter sampling methods may result in personnel exposure/injury to hot material containing benzene.	Consider evaluating current resid and desalter sampling procedures and replacing with safer alternatives. Reference MOC 19620, improvement of desalter triline sampling, In progress.
4A20	Full vacuum design for vessels?	Vessels are designed for full vacuum if needed, others are designed for 7.5 psi external pressure	
4A21	Heat exchangers designed for maximum pressure on both shell and tube sides?	Heat exchangers are protected by PSVs.	
4A22	Equipment designed to prevent incorrect assembly?	Maintenance procedures showing correct assembly are available for all equipment	
4A23	Clear identification of equipment status – valves with rising stems, spectacle blinds, check valves with flow arrow?	Rising stem gate valves, check valves with flow arrows and spectacle blinds are used in #4 Crude Unit	
4A24	Equipment designed to contain maximum pressure in the “worst credible event”?	Equipment protected by PSVs if needed to prevent loss of containment	

# INHERENTLY SAFER SYSTEMS REVIEW

Location: Chevron Richmond Refinery ABU: D&R Unit: #4 CRUDE UNIT  
PFD Number: PFD Title:  
Node Description:  
Design Conditions:  
Review Team: Facilitator - Mark Crow Process Engineer - Ben Purvis  
OPS - Jacques Cartier Design Engineer - Ben Hulse

Question ID:	Question	Discussion/Existing Safeguards	Recommendation
4B1	Blowout resistant gaskets?	All gaskets in the #4 Crude Unit are blowout resistant - spiral wound, ring joint, Kampro	
4B2	Increasing wall strength?	Piping classifications include a conservative wall thickness and an appropriate corrosion allowance for each service	
4B3	Using fewer seams and joints?	Seams and joints are minimized as currently designed	
4B4	Providing extra corrosion allowance?	Piping classifications include a conservative wall thickness and an appropriate corrosion allowance for each service	
4B5	Reducing vibration?	No vibration issues in #4 Crude Unit	
4B6	Minimizing the use of open-ended, quick-opening valves?	No open-ended valves in use in #4 Crude Unit	
4B7	Eliminating open-ended, quick-opening valves in hazardous service?	No open-ended valves in use in #4 Crude Unit	
4B8	Improving valve seating reliability?	No valve seating reliability issues in #4 Crude Unit	

# INHERENTLY SAFE SYSTEMS REVIEW

Location:	Chevron Richmond Refinery	ABU:	D&R	Unit:	#4 CRUDE UNIT
PFD Number:		PFD Title:		PFD Revision Date:	
Node Description:	-	Hazards:			
Design Conditions:					
Review Team:	Facilitator - Mark Crow OPS - Jacques Cartier	Process Engineer - Ben Purvis Design Engineer - Ben Hulse			
Question ID:	Question	Discussion/Existing Safeguards	Recommendation		
4B9	Eliminating unnecessary expansion joints, hoses, and rupture disc?	Rupture disks used in DEBRU. Hose use is limited to temporary activities (e.g., cleanup, truck offloading)			
4B10	Eliminating unnecessary sight glasses and glass rotameters?	Gage glasses and rotameters have metal protection around glass element			
5A1	Plant located to minimize need for transportation of hazardous materials?	Transportation of hazardous material is minimized			
5B1	Can materials be transported in less hazardous form; in a safer transport method; or by a safer route?	Materials are transported in the safest method			



## Chevron Integrated Risk Prioritization Matrix

For the Assessment of HES & Asset Risks from Event or Activity

Likelihood Descriptions & Index (with confirmed safeguards)			Legend	Legend applies to Identified HES risks see guidance documents for additional explanations						
Likelihood Descriptions		Likelihood Indices		Decreasing Likelihood						
Consequence can reasonably be expected to occur in life of facility	1	Likely		6	5	4	3	2	1	
Consequence may affect the consequences to other at the facility during its lifetime, or the event has occurred within the business cycle	2	Occasional		7	6	5	4	3	2	
Consequence may affect the consequences to other within the facility lifetime, or has occurred within the CPOC	3	Seldom		8	7	6	5	4	3	
Potentially beyond that the consequence may affect the facility, will affect several sites in industry, but not in CPOC	4	Unlikely		9	8	7	6	5	4	
Has impacted sites or entire within industry	5	Remote		10	9	8	7	6	5	
Risk is evaluated as	6	Rare		10	10	9	8	7	6	

Consequence Descriptions & Index (without safeguards)	Consequence Indices		Decreasing Consequence/Impact							
			6	5	4	3	2	1		
	Safety		Incident	Minor	Moderate	Major	Severe	Catastrophic		
			Workforce: Minor injury such as a sprain AND Public: No impact	Workforce: Minor injury such as a sprain AND Public: One or more minor injuries such as a sprain OR Public: One or more minor injuries such as a sprain AND Public: No impact	Workforce: One or more injuries/illnesses including permanent disability OR Public: One or more injuries/illnesses including permanent disability AND Public: One or more injuries/illnesses including permanent disability	Workforce: One or more injuries/illnesses including permanent disability AND Public: One or more injuries/illnesses including permanent disability	Workforce: Multiple injuries/illnesses OR Public: Multiple injuries/illnesses AND Public: One or more injuries/illnesses including permanent disability	Workforce: Multiple injuries/illnesses OR Public: Multiple injuries/illnesses AND Public: One or more injuries/illnesses including permanent disability	Workforce: Multiple injuries/illnesses OR Public: Multiple injuries/illnesses AND Public: One or more injuries/illnesses including permanent disability	
	Health		(Adverse effects resulting from chronic chemical or physical exposures or exposure to biological agent)	Workforce: Minor illness or effect with limited or no impact to ability to function and recovery is very likely or not necessary AND Public: No impact	Workforce: Minor illness or effect with limited or no impact to ability to function and medical treatment is limited or not necessary	Workforce: Minor illness or effect with limited or no impact to ability to function and medical treatment requiring medical treatment	Workforce: Serious illness or severe adverse health effect requiring a high level of medical treatment or management OR Public: Serious illness or severe adverse health effect requiring a high level of medical treatment or management	Workforce: (1-4) serious illness or chronic exposure resulting in facility or significant site threatening effects OR Public: (1-10) serious illness or chronic exposure resulting in facility or significant site threatening effects	Workforce: (5-10) serious illness or chronic exposure resulting in facility or significant site threatening effects OR Public: (11-100) serious illness or chronic exposure resulting in facility or significant site threatening effects	Workforce: (100+) serious illness or chronic exposure resulting in facility or significant site threatening effects OR Public: (>100) serious illness or chronic exposure resulting in facility or significant site threatening effects
			Environment	Impact such as localized or short term effects on habitat, species or environmental media	Impact such as localized long term degradation of sensitive habitat or widespread, short term impacts to habitat, species or environmental media	Impact such as localized but irreversible habitat loss or widespread, long term impacts on habitat, species or environmental media	Impact such as long term irreversible habitat loss or widespread, long term impacts on habitat, species or environmental media (e.g. watershed degradation)	Impact such as permanent irreversible habitat loss or widespread, long term impacts on habitat, species or environmental media (e.g. watershed degradation)	Impact such as permanent irreversible habitat loss or widespread, long term impacts on habitat, species or environmental media (e.g. watershed degradation)	Loss of a significant portion or a reduced capacity or loss of effective ecosystem function or a landscape scale

The above legend applies only to HES risks, where risk levels 1-6 are actionable and mandatory.									
For risks that may result in facility damage, business interruption, loss of product, the "Assets" category below should be used.									
Asset risk reduction is at the discretion of management. Under no circumstances may a direct or indirect translation of Asset loss to HES consequences, or between any discrete categories of HES consequences be inferred.									

Consequence Descriptions & Index (without safeguards)	Consequence Indices		6	5	4	3	2	1
			Incident	Minor	Moderate	Major	Severe	Catastrophic
Assets	Facility Damage, Business Interruption, Loss of Product	Minimal damage, Negligible direct loss of asset value, Costs <\$100,000	Some asset loss, damage and/or downtime, Costs \$100,000 to \$1 million	Significant asset loss, damage to facility and/or downtime, Costs of \$1-10 million	Major asset loss, damage to facility and/or downtime, Costs \$10-100 million	Severe asset loss or damage to facility, Significant downtime, with appreciable economic impact, Cost >\$100 million	Total disruption to company, Facility or permanent loss of production, Cost >1 billion	

This matrix is endorsed for use across the Company.

It is not a substitute for, and does not override any relevant legal obligations.

This matrix identifies health, safety, environmental and asset risks and is to be used only by qualified and competent personnel.

Where applicable it is to be used within the Riskman2 structure and governance of an ERM Management Process. If applied outside of these Processes, it is also mandatory to manage identified intolerable risks and comply with the Risk Mitigation Closure Guidelines.

## Nodes

Nodes	Nodes	Drawings	Design Intention
1. Crude Feed and Startup/Shutdown Piping, Including P-1101A/B/C through shell side of E-1101A/B/C/D, up to inlets of E-1104 and E-1102A/B/C. [Revalidated]		D-328852-5 D-308300-22 D-308301-12 D-335235-8 D-308336-11 D-308354-13 D-335233-8 D-335234-9	The purpose of this section is to preheat crude feed and cool atmospheric column overhead stream.
2. This section is the C-1100 overhead vapor train. It includes E-1101A/B/C/D tube sides, E-1100A/B/C/DEF, and V-1100. [Revalidated]		D-328852-5 D-328855-3 D-308308-20 D-308300-22 D-308313-8 D-308314-22	The purpose of this section is to cool and condense the overhead stream from C-1100.
3. Recycle Water from V-1100 boot, through P-1103/A to overhead line of C-1100, and to V-1160. Also includes sour water from V-1104 water boot to V-1160 [Revalidated]		D-328855-3 D-328857-3 D-308314-22 D-308300-22 D-308333-16	The purpose of this section is to quench the overhead stream to manage chlorides and prevent corrosion in overhead condensers.
4. Naphtha from V-1100 to Atmospheric Column overhead through pumps P-1100A/B/C. Includes export through V-1104, E-1195, and E-1185A/B to inlet of C-1190. Slipstream for corrosion inhibitor no longer used, blinded. [Revalidated]		D-328855-3 D-328857-3 D-328858-3 D-308314-22 D-308300-22 D-308317-22 D-308308-20	The purpose of this section is to control temperature of C-1100 overhead, and to preheat and provide feedstock to C-1190.
5. Off-gas from V-1100 to and Including V-1170, to the inlets of the first stages of K-1100A/B. Includes P-1171B. [Revalidated]		D-328855-3 D-328857-3 D-328858-3	The purpose of this section to export non-condensibles from C-1100 to the K-1100s.

Nodes	Drawings	Design Intention
D-308314-22		
D-308315-19		
D-308316-13		
D-308319-19		
D-328855-3	The purpose of the section is to provide sponge gas to C-1190. Also provides pressure control for C-1190, V-1100 and C-1100 overhead. Excess can be sent to 5H2S Plant when needed (not normal operation).	
D-328858-3		
D-308313-8		
D-308315-19		
D-308317-22		
D-308333-13		
D-308316-13		
D-328858-3	The purpose of this section is to provide hot stabilized feed to the #5NHT plant and to provide cold feed to the NHT cold feed tanks.	
D-308317-22		
D-335232-7		
D-308299-10		
D-328858-3	The purpose of this section is to provide steam heat to the bottoms of C-1190, to stabilize naphtha and to remove and recover condensate.	
D-308317-22		
D-308342-13		
D-328858-3	The purpose of this section is to cool and condense of C-1190 overhead vapors.	
D-308317-22		
D-308318-19		
D-308349-11		
D-328858-3	The purpose of this section is to provide reflux to C-1190 and excess LPG to C-860.	
D-308317-22		
D-308318-19		
D-335232-7		
D-328857-3	The purpose of this section is to provide three-phase separation and pressure control for C-1190 overhead, and to vent off-gas to either K-1171/A or relief.	
D-328858-3		
D-308318-19		
D-308332-17		

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	Nodes	Drawings	Design Intention
12. Desalting Chemical to V-1106A through P-1106/A to the suction of P-1101A/B/C. [Revalidated]	D-308331-16 D-328852-5 D-308320-18 D-308300-22		The purpose of this section is to provide desalting chemicals to the crude feed.
13. Ammonia Injection Pumps P-1108/A and Aqueous Ammonia to C-1100 via the C-1110 overhead vapor line, and aqueous ammonia to C-1160. Includes T-1108. [Corrosion inhibitor from corrosion inhibitor injection pumps P-1107, V-1107/A to C-1100 overhead line. Out of service] [Revalidated]	D-328855-3 D-328856-5 D-308320-18	The Purpose of this Section is to Provide Ammonia to C-1100 and C-1160 to Control pH and Prevent Corrosion of the Overhead System. This System Also Blends Ammonia to Proper Concentration. This Section is Batch Operated and Used When Level in T-1108 is Low.	[Provides corrosion inhibitor to C-1100 overhead system to prevent corrosion. The corrosion inhibitor equipment in this section is out of service and only Hazop'd for one situation - a potential backflow incident.]
14. Crude From E-1101A/B/C/D Through E-1102A/B/C, E-1103 and HIC-531. [Revalidated]	D-328852-5 D-308301-12	The purpose of this section is to provide preheat to the crude feed while cooling VTCR and No. 2 sidecut streams.	
15. Crude From E-1101A/B/C/D Through E-1104, E-1105A/B, E-1106, E-1163A/B and HIC-532. [Revalidated]	D-328852-5 D-308301-12	The Purpose of this Section is to Provide Preheat to the Crude Feed While Cooling No. 2 SIC, No. 1 SIC, ATCR, and Vacuum Residuum.	
16. Crude Through E-1107A/B to Desalter Inlet, including desalter bypass line. [Revalidated]	D-328852-5 D-308301-12 D-308302-20	The purpose of this section is to continue heating crude through the E-1107's and to provide preheated feed to the desalter. This section has the capability of bypassing the desalter.	
17. Desalter V-1102 Including Desalted Crude to Flash Drum V-1103, PC-51. [Revalidated]	D-328852-5 D-328853-4 D-308302-20 D-308303-15	The purpose of this section is to dehydrate and desalt crude feed and control the pressure in the desalter	
18. Desalting Water from V-1108 through P-1109/A and E-1123A/B to V-1102 inlet, and high pressure desalting water from V-1109 through P-1109B to the inlet of E-1102A/B/C or E-1107A/B. [Revalidated]	D-328852-5 D-308323-14 D-308301-12 D-308300-22 D-308302-20	The purpose of this section is to move desalter effluent water from V-1102 to DEBRU; to flush V-1102 water in C-1180 to remove benzene. The overhead vapor can be routed to V-3211 (normal) or E-1175. Also removes benzene from desalter effluent water by routing it from the outlet of LV-080 through T-326.	
19. C-1180 Desalter Effluent Flash Column. Includes effluent water from V-1102 to C-1180; C-1180 bottoms through P-1180/A through E-1123A/B, E-1125 to inlet of T-3126; and C-1180 overhead to V-3211 or through E-1175 to inlet of V-1175.	D-328852-5 D-328857-3 D-328859-3	The purpose of this section is to move desalter effluent water from V-1102 to DEBRU; to flush V-1102 water in C-1180 to remove benzene. The overhead vapor can be routed to V-3211 (normal) or E-1175. Also removes benzene from desalter effluent water by routing it from the outlet of LV-080 through T-326.	

[Revalidated]	Nodes	Drawings	Design Intention
20. V-1109 makeup water, including off-pot boiler feed water (D-852), V-1160 water and soft water. [Revalidated]	D-328852-5 D-328857-3 D-308340-16 D-308323-14 D-308331-16 D-308332-17 D-308318-19	The Purpose of this Section is to Provide Makeup Water to V-1109, and excess sour water to V-1175.	
21. Desalter Water Tank V-1109, oil skim line to P-1198 and sour off-gas to vent gas recovery. [Revalidated]	D-328852-5 D-328857-3 D-308323-14 D-308348-20 D-308332-17	The purpose of this section is to degass and skim oil from V-1109 desalter, water break tank.	
22. Desalted Crude Effluent Flash Drum V-1103, including bottoms through and including P-1102A/B/C, to inlet line of E1108A/B/C and E-1112; and overhead vapor to C-1100. [Revalidated]	D-328853-4 D-328855-3 D-308303-15 D-308304-15 D-336674-3 D-308308-20 D-328855-3	The purpose of this section is to provide flashed crude at high pressure to the secondary heat exchanger train, and to supply a flashed crude slipstream to the caustic mixer for chloride control. Also to flash hot, light material in crude to C-1100 via V-1103 overhead vapor line, and to flash off any remaining entrained water.	
23. Hot Crude Recycle Line from P-1148 outlet and E-1165A/B to V-1103 overhead inlet. [Revalidated]	D-328853-4 D-308303-15 D-308305-24 D-308309-21	Provide pre-heat to V-1103 to increase salt removal in the flash drum.	

Nodes	Drawings	Design Intention
24. Desalted Crude From P-1102 through E-1108/A/B/C, E-1109, E-1110/A/B, E-1111, E-1165A to the inlet line of F-1100/A/B. Includes HIC-541. [Revalidated]	D-328853-4 D-308304-15 D-308305-24	The purpose of this section is to preheat crude prior to entry to F-1100 while cooling products.
25. Desalted Crude from P-1102 through E-1112, E-1113, E-1114, E-1115, E-1116A-F and E-1165B to the inlet of F-1100/A/B. Includes HIC-542. [Revalidated]	D-328853-4 D-308304-15 D-308305-24	The purpose of this section to preheat crude prior to entry to F-1100 while cooling products.
26. Desalted Crude from HIC-541 and HIC-542 Through F-1100/A/B to the Atmospheric Column C-1100. [Revalidated]	D-328853-3 D-328853-4 D-336670-6 D-336672-5 D-308308-20 D-308305-24	The purpose of this section is to provide desalted, preheated crude to the furnaces, F-1100/A/B. In this section, the crude is heated and vaporized to the proper temperature and sent to C-1100 flash zone.
27. Atmospheric Column Furnaces F-1100/A/B, including fuel gas system from F-1100/A/B fuel gas pressure controllers, through choppers, to furnace fuel gas headers PV-111/211. [Revalidated]	D-328853-4 D-308322-22 D-336670-6 D-336671-6 D-336672-5 D-336673-5 D-308321-17	The purpose of this section is to add last heat to crude feed stream before entering C-1110, to provide fuel gas to the furnaces.
28. Caustic injection from T-1104 through P-1104, through the inline mixer to F-1100/A/B inlet line. [Revalidated]	D-336670-6 D-336674-3 D-308340-16	The purpose of this section is to supply caustic to the inlet of F-1100/A/B in order to neutralize chlorides in the crude feed.
29. #1 Sidecut Draw from C-1100 to and including C-1110. [Revalidated]	D-328853-3 D-308308-20 D-308310-17	The purpose of this section is to provide a surge for the P-1119/1129A. E-1117 is out of service. This column no longer acts as a stripper.
30. Atmospheric Bottoms Circulating Reflux From C-1100 Through P-1148/A, E-1111, and E-1148 back to C-1100. Note current routing bypasses both E-1115 and E-1117. [Revalidated]	D-328853-3 D-328853-4 D-308310-17 D-308309-21 D-308308-20	The purpose of this section is to provide cooling to C-1100 using #4 sidecut by exchanging heat with crude coming into the plant and generating steam.

Nodes	Drawings	Design Intention
D-308304-15	D-308305-24	The purpose of this section is to provide hot #1 sidecut to the JHT plant while pre-heating crude, and to cool 1 s/c product going to tankage. (Tank T-297 has been taken out of service.)
D-308310-17	D-328863-1	
D-308301-12	D-308312-19	
D-308324-17	D-3083232-7	
D-335233-8		
D-328855-3	D-328855-3	The purpose of this section is to flash #2 sidecut (Jet) in C-1120, and to provide stripped #2 sidecut to the JHT plant while pre-heating crude and cooling product going to tankage.
D-328852-5	D-328863-1	E-1127 out of service.
D-308308-20	D-308308-20	
D-308310-17	D-308343-12	
D-308312-19	D-308312-19	
D-308349-11	D-308301-12	
D-335233-8	D-335233-8	
D-328855-3	D-328855-3	The purpose of this section is to cool VBCR to C-1160, provide preheat to crude in E-1116's and generate 150# steam in E-1188. System also provides 8 s/c as pumpback to C-1160 and 7 s/c emergency quench to pumpback system. This system provides 8 s/c product to P-1189/A.
D-328856-5	D-308326-20	
D-328863-1	D-310463-19	
D-308310-17	D-308310-17	
D-308305-24	D-308327-17	
D-308304-15	D-308304-15	

Nodes	Drawings	Design Intention
34. #8 S/C splits from VBCR at outlet of E-1116A-F through and including P-1189/A and E-1114 to RLQP (HNCAT(CC). Also includes 8 slide cut excess through E-1164E/F cell to RLQP cold feed. [Revalidated]	D-328856-5 D-355617-1 D-308327-17 D-308324-17 D-308304-15 D-308338-11 D-324146-9	The purpose of this section is to route #8 sidecut through P-1189/A and E-1114 to RLQP and excess to tankage. E-1114 provides preheat to crude. P-1189/A is a common spare for P-1179 and P-1189.
35. #3 Sidecut from C-1100 to C-1130 then through P-1139/P-1149A and E-1112, then to the DHT or through E-1139 and to washoff tankage. Also includes stripping steam to C-1130. [Revalidated]	D-328855-3 D-328853-4 D-328863-1 D-308311-22 D-308308-20 D-308304-15 D-308312-19 D-308324-17 D-335233-8	The purpose of this section is to provide #3 sidecut to the DHT Plant, while preheating crude in E-1112. This system also cools #3 sidecut in E-1139 when going to tankage.
36. C-1140 And Auxiliary Piping. Includes Vapor Return From C-1149 To C-1100 [Revalidated]	D-308306-20 D-308311-22	C-1140 is Out Of Service.
37. #4 sidecut bypassed around C-1140 through P-1149/A and E-1113 to TKN hot oil then through E-1149 to tankage. This also includes the seal flush system and associated filters to the light oil pumps. [Revalidated]	D-328853-4 D-328855-3 D-328863-1 D-355617-1 D-308304-15 D-308308-20 D-308311-22 D-308312-19 D-308355-15 D-308353-10 D-308324-17 D-308338-11	The purpose of this section is to provide #4 sidecut to TKN and also provide seal flush to all light oil pumps. This section also provides crude preheat through E-1113. P-1149/A is a spare for both #3 and #4 sidecut. #4 sidecut is also a backup for #7 sidecut seal flush.

	Nodes	Drawings	Design Intention
38. #5 sidecut pumpback through P-1158/A, through FV-059, and pumped back to C-100. [Revalidated]	D-339233-8 D-328855-3 D-308308-20 D-308309-21		The purpose of this section is to provide #5 side cut pumpback to C-1100, preventing asphaltines from rising in column.
39. #5 side cut from P-1159/A through E-1115 to E-1149 and to hot #5 S/C TKN feed. P-1159/A and run-down piping now used for 6 s/c service (covered in 6 s/c HAZOP). [Revalidated]	D-308309-21 D-308304-15 D-308312-19 D-308324-17		The purpose of this section is pumpout and cool down #5 side cut tray level during shutdown, cleanup, and startup. #5 s/c as a product is no longer in service, and system is blinded to suction of P-1159/A.
40. C-1160 overflash through P-1178/A through E-1178 recycles to C-1160 and excess to C-1100. [Revalidated]	D-328855-3 D-328856-5 D-308326-20 D-308327-17 D-308308-20		The purpose of this section is to provide overflash liquid quench to C-1160 and to recycle overflash liquid to C-1100. E-1178 cools the C-1160 overflash quench by converting boiler feed water to steam. P-1187 is currently out of service and blinded.
41. JHT/DHT Naphtha to C-1100. Combined with node 43. [Revalidated]	D-328855-3 D-308308-20 D-335232-7		The purpose of this section is to route JHT/DHT naphtha back to C-1100 for reprocessing. This can be routed to the overflash recycle line or to C-1100 (not normal operation). Combined with node 43.
42. Pump vents from P-1105/A, P-1168/A, P-1169, P-1178/A, P-1179, P-1188/A & P-1165/A. [Revalidated]	D-308326-20 D-308328-15 D-308327-17 D-357210-0		The purpose of this section is to route the case vents of the hot vacuum oil pumps to C-1160 flash zone. P-1187 is currently out of service and blinded.
43. Atmospheric top circulating reflux through P-1128, split through E-1107's or E-1108's, then together through E-1106 and E-1128 fin fans to C-1100. Includes JHT/Rheniformer naphtha from pilot limit manifold to ATCR and V-1100. Also includes JHT/DHT Naphtha to C-1100. [Revalidated]	D-328852-5 D-328853-4 D-328855-3 D-308308-20 D-308301-12 D-308304-15 D-308309-21 D-335232-7 D-328855-3		The purpose of this section is to cool C-1100 by using ATCR to exchange heat with the crude feed. Includes JHT/Rheniformer naphtha from pilot limit manifold to C-1100 and V-1100. Naphtha is not normally routed to C-1100.
44. Atmospheric column bottoms from P-1105/A through F-1160 to the inlet of C-1160.	D-328856-5		The purpose of this section is to heat atmospheric bottoms by routing it through F-1160 to C-1160 vacuum column. P-1105/A also routes atmospheric bottoms to F-1100/A/B as

[Revalidated]	Notes	Drawings	Design Intention
	D-308308-20 D-357211-2 D-336727-4 D-308326-20 D-336670-6		emergency short loop circulation.
45. Atmospheric column C-1100 and auxiliary piping. [Revalidated]	D-326855-3 D-308308-20		The purpose of this section is to distill crude feed into overhead gasoline, atmospheric bottoms and four different sidecut products (sic 1-4).
46. Boiler feed water and make-up through FV-444 through F-1100A/B and F-1160 to V-1177. Boiler feedwater recycle from V-1177 through P-1177/A to E-1148, E-1178, F-1188, E-1178, E-1148, E-1177/A to E-1148, E-1178, F-1188, F-1100A/B, and F-1160 for wet 150# wat steam. Includes BFW, Superheated Steam to C-1100. Includes Steam drum V-1177 and auxiliary piping. Includes velocity steam for F-1160. [Revalidated]	D-326855-3 D-328856-5 D-328853-4 D-308336-14 D-308342-13 D-308343-12 D-336727-4 D-336728-6 D-336571-6 D-336673-5 D-308340-16 D-308308-20 D-308327-17		The purpose of this section is to provide boiler feed water make-up to V-1177 via F-1100A/B and F-1160. Additionally, recycle boiler feed water is circulated from V-1177 through P-1177/A to E-1148, E-1178, F-1188, E-1178, E-1148, E-1177/A to E-1148, E-1178, F-1188, F-1100A/B steam generation back to V-1177.
47. 50 PSIG steam knock-out drum V-1164 and auxiliary piping. Includes saturated steam through F-1160 to C-1160. [Revalidated]	D-328856-5 D-308336-14 D-336728-6 D-308326-20 D-308343-12 D-308340-16 D-308342-13		The purpose of this section is to knock-out liquid from 50 PSIG steam in V-1164, superheat the saturated steam in F-1160, and provide superheated steam on flow control to C-1160 as stripping steam.
48. V-1169 Coke knockout drum and auxiliary piping. This system is out of service [Revalidated]			Additionally, decoking of the furnaces is now done by pigging, not by steam-air decoking.
49. Vacuum column furnace F-1160.	D-3228856-5		The purpose of this section is to provide additional heat to C-1100 bottoms liquid through

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[Revalidated]	D-336727-4	F-1160. Fuel gas is the heating medium in F-1160.	
	D-336728-6		
	D-308335-16		
50. Steam separator V-1101 and auxiliary piping. Includes steam and C-1160 overhead vapors through K-1160A/B/C/D, K-1161A/B/C and K-1162A/B/C, and E-1160A/B, E-1161, E-1162; to inlet of V-1160. [Revalidated]	D-328832-5 D-328856-5 D-328857-3 D-308326-20 D-308330-10 D-308331-16	This section is to route the C-1160 overhead gases through a series of eductors and exchangers to condense liquids and route them to V-1160. Also maintains vacuum in C-1160.	The purpose of this section is to route the C-1160 overhead gases through a series of eductors and exchangers to condense liquids and route them to V-1160. Also maintains vacuum in C-1160.
51. Vacuum column overhead seal drum V-1160, and auxiliary piping. Includes V-1160 oil through P-1160/A and V-64 to crude feed. Sour water from V-1160 through P-1163/A and LV-063 to V-1109/V-1175. [Revalidated]	D-328857-3 D-328852-5 D-308331-16 D-308300-22 D-308341-8 D-308323-14	This section also includes the vacuum breaker PV-631, and fuel gas to inlet of K-1161s. [Revalidated]	The purpose of this section is to collect all liquids and gases from the overhead of C-1160 into V-1160. V-1160 also collects the liquid from the water boots of V-1190, V-1100, and V-1104. The liquids (oil and water) are separated and pumped off and the vapor is routed to the vent gas recovery compressors, K-1171/A. V-1160 hydrocarbons are routed through P-1160/A to crude feed or to the atmospheric off-test header on level control. V-1160 water is routed through P-1163/A and LV-063 to V-1109/V-1175.
52. C-1160 vacuum column bottoms through P-1165A, K-1165A/B, E-1165A/B and E-1110A/B, (through E-1163A/B and LV-061 to SDA tankage. [Revalidated]	D-328856-5 D-308301-12 D-308305-24 D-308326-20 D-308328-15 D-308329-11 D-308338-11 D-340940-5 D-358954-1	This section is to pump C-1160 bottoms using P-1165/A through E-1165A/B in parallel flow, then through E-1110A/B in series flow through E-1163A/B, preneating crude feed. Resid is then routed through LV-061 to the plot limit. Resid export is normally routed to SDA tankage, but may be routed to E-1164S for long loop.	The purpose of this section is to pump C-1160 bottoms using P-1165/A through E-1165A/B in parallel flow, then through E-1110A/B in series flow through E-1163A/B, preneating crude feed. Resid is then routed through LV-061 to the plot limit. Resid export is normally routed to SDA tankage, but may be routed to E-1164S for long loop.
53. Resid quench to C-1160 and emergency bypass to F-1160. [Revalidated]	D-328856-5 D-308329-11 D-308326-20 D-336727-4 D-308305-24	The purpose of this section is to provide resid quench to C-1160 bottoms and emergency bypass flow (short loop) to F-1160.	The purpose of this section is to provide resid quench to C-1160 bottoms and emergency bypass flow (short loop) to F-1160.
54. E-1166 and auxiliary piping. E-1166 out of service [Revalidated]	D-308363-4	E-1166 out of service	E-1166 out of service

Nodes	RU Plant	#4 Crude/	Drawings	Design Intention
55. Vacuum residuum from E-1166 through E-1167AB. E-1167AB out of service and removed from plant. [Revalidated]	D-308363-4	E-1167AB out of service and removed from plant.		
56. Vacuum Residuum through P-1167 and FV-652 to 5 Tar Line. Includes FV-653 (min flow bypass) [Revalidated]	D-3288856-5 D-308329-11 D-308338-11	The purpose of this section is to boost vacuum resid through P-1167 to No. 5 Tar Liner/Tar Coolers.		
57. #6 Sidecut from C-1160 to the suction of P-1169 and/or P-1159/A to TKN hot feed via FV-061 or FV-051. Includes 6 s/c cold to tankage via E-1149. [Revalidated]	D-3288856-5 D-328863-1 D-335617-1 D-308304-15 D-308309-21 D-308312-19 D-308324-17 D-308326-20 D-357210-0	The purpose of this section is to route #6 sidecut through P-1169 and/or P-1159/A to TKN hot or cold tankage. The 6 s/c system now uses 5 s/c run-down piping and pumps due to increased feed rates.		
58. Vacuum top circulating reflux from C-1160 to the suction of P-1168/A through E-1102A-C and E-1168 to C-1160 via FV-069 and K-1168A/B. [Revalidated]	D-3288856-5 D-308301-12 D-308326-20 D-357210-0	The purpose of this section is to provide vacuum top circulating reflux using P-1168A through E-1102s, E-1168 and K-1168A/B, back to C-1160. E-1102s provide preheat to crude.		
59. #7 Sidecut from C-1160 through P-1179/P-1189A to RLOP/TKN. 7 s/c also provides seal flush to heavy oil pumps. [Revalidated]	D-3288856-5 D-335617-1 D-308304-15 D-308324-17 D-308326-20 D-308327-17 D-308338-11 D-308352-15	The purpose of this section is to route #7 sidecut through P-1179/P-1189A, then through K-1109A/B, and through E-1109 to RL OP or excess to TKN feed header. 7 s/c also provides seal flush to heavy oil pumps via K-1179s. E-1109 provides preheat to crude. P-1189A is a common spare for P-1179 and P-1189.		
60. C-1160 Vacuum Column and auxiliary piping. [Revalidated]	D-3288856-5 D-308326-20	The purpose of this section is to further distill C-1100 bottoms into three vacuum sidecuts, (SIC #6, 7, 8) and vacuum resid.		
61. Reflux from V-1180 to C-1180 [Revalidated]	D-308319-19	This section is out of service and is air-gapped. Reflux pumps have been removed.		
62. V-1180, including auxiliary piping and condensate to V-1175 degasser	D-308319-19	This section is out of service, and is air-gapped.		

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and to seal drum V-1160. [Revalidated]	D-308331-16	D-308332-17	The purpose of this section is to route off-plot sour water streams through E-1175 to V-1175, or directly to V-1175; then to degas sour water in V-1175 and skim V-1175 oil to V-1198; and to route sour water from V-1175 through P-1175/A to off-plot tankage.
63. V-1175 and auxiliary piping. Includes sour water from 5H2S, DHT & NHT through E-1175 to V-1175, and sour water from V-1175 through P-1175/A to T-398 via LV-073. Also includes vent gas from JHT, DHT & NHT to V-1175. [Revalidated]	D-328557-3 D-310587-2 D-308332-17 D-335234-9	D-328557-3 D-310587-2 D-308331-16 D-308332-17	The purpose of this section is to route V-1175, V-1160 vent gas and relief gas through E-1171/A to V-1171 (vent gas recovery compressor first stage knockout drum). The inlet to E-1171 has a loop seal tied to reliefs to minimize pressure in the vent gas system in the event of loss of K-1171 compressors
64. Vent gas from V-1175 and V-1160, and relief gas to inlet of V-1171 via E-1171/A. Includes loop seal and LV-079. [Revalidated]	D-328557-3 D-310587-2 D-308331-16 D-308332-17	D-328557-3 D-310587-2 D-308332-17	The purpose of this section is to route V-1175, V-1160 vent gas and relief gas through E-1171/A to V-1171 (vent gas recovery compressor first stage knockout drum). The inlet to E-1171 has a loop seal tied to reliefs to minimize pressure in the vent gas system in the event of loss of K-1171 compressors
65. V-1171 Vent gas recovery knockout drum and auxiliary piping. Includes V-1171 bottoms through P-1171/A to P-1198 suction. [Revalidated]	D-328557-3 D-310587-2 D-308332-17	D-328557-3 D-310587-2 D-308332-17	The purpose of this section is to remove liquid from vent gas in V-1171, and to route liquid through P-1171/A to P-1198 suction.
66. Vent gas from V-1171 through K-1171/A first stage, through vent gas recovery interstage cooler, E-1172/A to inlet of V-1172/A. [Revalidated]	D-328557-3 D-310587-2 D-308332-17 D-308333-13 D-308334-12 D-308348-20	D-328557-3 D-310587-2 D-308333-13 D-308334-12 D-335234-9	The purpose of this section is to route V-1171 vent gas through K-1171/A first stage and E-1172/A to the inlet of V-1172/A.
67. Vent gas through and including V-1172/A, through and including K-1171/A second stage to #5 H2S Plant; and liquid from V-1172/A to LC-075/078 to relief. Includes K-1171/A spillback controller. [Revalidated]	D-328557-3 D-310587-2 D-308333-13 D-308334-12 D-335234-9	D-328557-3 D-310587-2 D-308333-13 D-308334-12 D-335234-9	The purpose of this section is to knock out any uncondensed materials from K-1171/A first stage in V-1172/A. The uncondensed vent gas is then routed through K-1171/A second stage to the #5 H2S plant. The compressor spillback is routed to the inlet of E-1171/A. Liquid from V-1172/A is routed to relief.
68. Fuel Gas Boundary Through V-1196 and 100 Foot Block Valves, through K-1196 to fuel gas pressure regulators for F-1100A/B and F-1160 [Revalidated]	D-328553-4 D-340438-4 D-308341-8 D-308346-14 D-308347-17	D-328553-4 D-340438-4 D-308341-8 D-308346-14 D-308347-17	The purpose of this section is to route fuel gas through V-1196, fuel gas knockout drum, to the 100 foot block valve of the furnaces, through K-1196 to fuel gas pressure regulators for F-1100A/B and F-1160. In addition, fuel gas is routed to various pieces of equipment.
69. Cooling Water Towers E-3400, E-521 and pumps P-3400/A. Also	D-310472-0	D-310472-0	The purpose of this section is to provide cooling water supply from P-3400/A to various

Nodes	Drawings	Design Intention
includes water from P-526A/B. [Revalidated]	D-308344-13 D-308340-16 D-30835-9 D-313648-6 D-313649-6 D-303655-11 D-328829-11	pumps, coolers, and instrumentation. P-526A/B provide cooling water to overhead condensers.
70. V-1198 relief knockout drum and pump P-1198. Includes V-1198A (not in use), [Revalidated]	D-308348-20 D-335234-9 D-308354-13 D-308349-11 D-308322-22	The purpose of this section is to knock out liquids in the relief system using V-1198. The gases are routed to the flare and flare gas recovery; liquid is pumped through P-1198 to V-3211.
71. E-1164A/B/C/D, Includes # 46/778 slidecuts and resid through E-1164A/B/C/D to 10" off test or long loop to front of plant (PV-651). [Revalidated]	D-335617-1 D-324146-9 D-308338-11 D-335235-8 D-308324-17	The purpose of this section is to cool offtest products in E-1164A/B/C/D before routing them to off-test tankage or back to crude feed on startup circulation. 150 PSIG steam is routed through E-1164 coolers on a separate coil to prevent setting up.
72. DEBRU recovered oil, including T-3126 Recovered Oil Tank, Surge Boxes D-3110/D-3111, Skimmed Oil Tank V-3212. Includes associated pumps P-3144/A Filter Feed Pumps, P-3192/A Skinned Oil Pumps. Also includes Bag Filters K-3140/A/B and Calgon carbon drums 1-6. Also includes recovered oil from T-3126 through P-642 and P-84 to T-3211 (Utilities). [Revalidated]	D-328859-3 D-328860-2 D-311337-21 D-313790-12 D-254316-12 D-312470-12	The purpose of this section is to remove skinned recovered oil from DEBRU and route it to either #4 Crude for reprocessing or to T-3211. This section also separates additional oil and water in D-3110/3111, sends skim oil to V-3212 and water through P-3144/A to bag filters K-3140/A/B and Calgon carbon drums 1-6.
73. DEBRU Vent Gas System, including nitrogen to D-3110/3111 and V-3212; and D-3110/3111 vent gas to V-3212 then to V-3115 Knockout Pot. Includes vent gas through Eductor K-3215 and to F-1100B, and liquid through Sarco Pumping Traps K-3115/A/B back to V-3212. [Revalidated]	D-328859-3 D-311337-21 D-308322-22	The purpose of this section is to provide nitrogen to DEBRU surge boxes and route excess vent gas through V-3212 and V-3115 to F-1100B. This also includes the DEBRU burner system at F-1100B.
74. Startup/Shutdown Issues - Unit-wide		
75. "Wrap-up" Discussion of Issues General to the 4 CU Plant.	D-308311-22 D-308355-8 D-328829-11	

Chevron Refinery

#4 Crude / RU Plant

Analysis Dates: 8/31/2009 - 1/1/2009